MACHINE DESIGN

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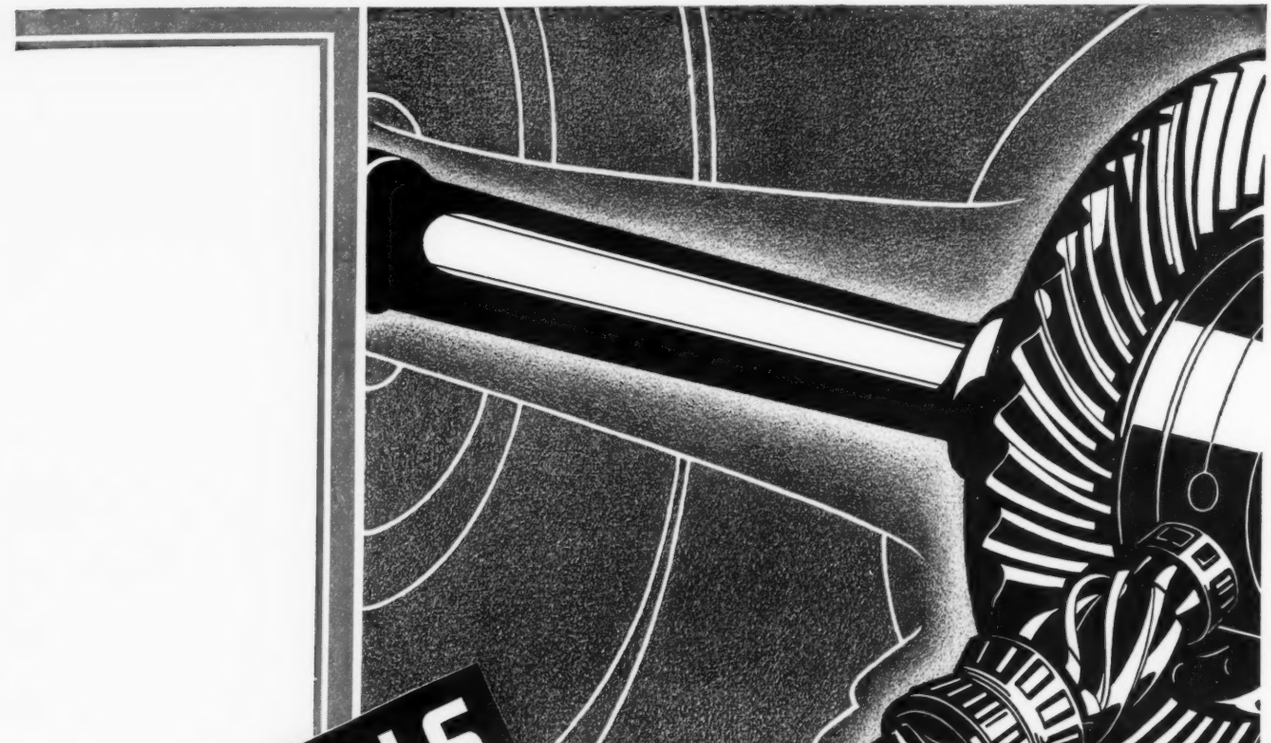

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FOR axles and shafts requiring high torsional strength, Illinois is producing a Chrome-Nickel-Moly steel that has achieved notable successes. This steel has an unusual capacity for absorption of torsional stresses. Hence, failures are rare.

Chrome-Nickel-Moly, despite its superior physical properties, presents no unusual machining difficulties.

For trucks and bus axles, jack shafts on power excavators and cranes, and for many applications where additional strength is required without a corresponding increase in the size or weight of a shaft, it will pay to investigate Illinois' Chrome-Nickel-Moly.

Additional information will be sent upon request.

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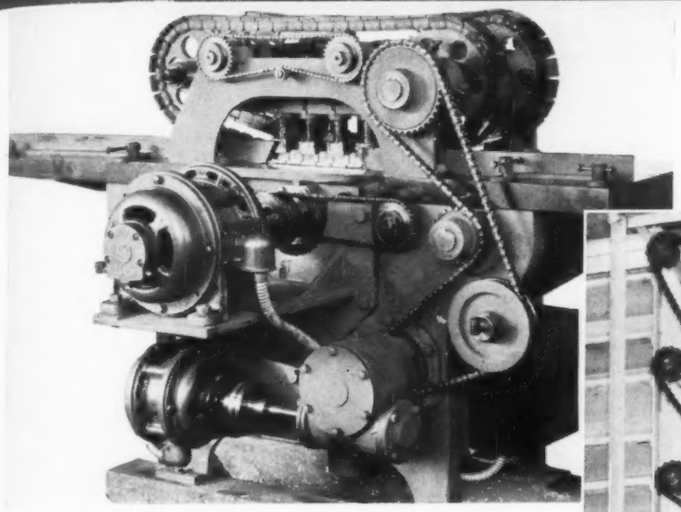
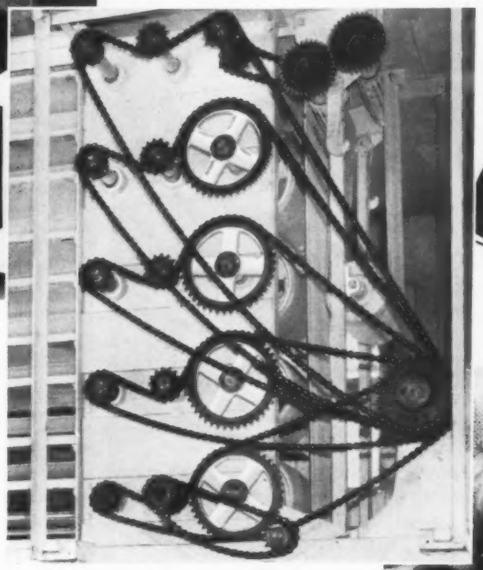
FROM INTRICATE MACHINERY APPLICATIONS TO DIFFICULT MOTOR DRIVES

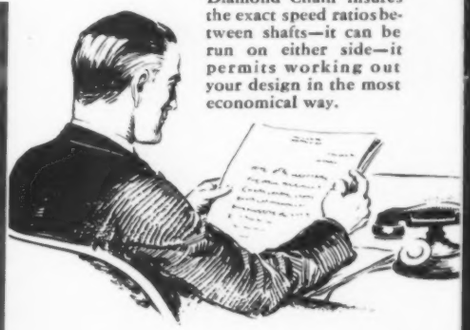


The designers of this rip saw have applied Diamond high efficiency Chain for intermachine drives and Diamond Chain was also built into cast iron feed chains running under spring pressure guide shoes. The feed works is also driven by Diamond.



For the
Designers

Diamond Chain insures the exact speed ratios between shafts—it can be run on either side—it permits working out your design in the most economical way.

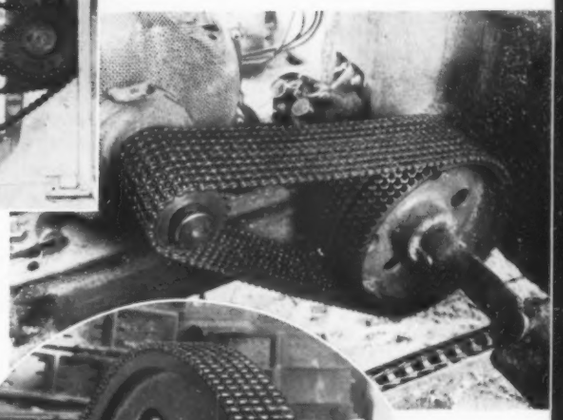


Diamond Roller Chain
meets precise requirements

For forty years designers of machinery have applied Diamond Chain in a wide variety of ways—to interconnect and drive multiple shafts—to operate conveyor flights—to synchronize various motions—and for the primary or motor drives.

Likewise production managers have applied Diamond Roller Chain for the usual and unusual motor drives—reducing power losses and cutting maintenance costs because of the longer life. And when these men buy machinery equipped with chain—they readily appreciate the added value if the "Diamond" mark is on the links. DIAMOND CHAIN & MFG. CO., 435 Kentucky Ave., Indianapolis, Ind. *Offices and Distributors in All Principal Cities.*

Above: Many shafts driven in certain relation to each other as to speed and direction—5 drives from one sprocket—an interesting example of the machinery designer's use of Diamond Roller Chain.

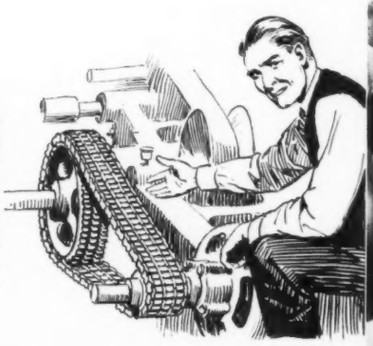


An eight-strand Diamond Drive which replaced another transmission on this automatic trimmer driven by 50 h.p., 1160 r.p.m. motor.

Sand-mixer drive in foundry—20 h.p. motor, 1160 r.p.m.—quintuple strand high efficiency Diamond Roller Chain. Center distance between drives and driven sprockets—39½"; 9.4 to 1 ratio.

For the
Production Men

The anti-friction roller bearing principle—the high maintained efficiency (98.99%)—mean reduced power consumption and lower power bills where Diamond Motor Drives are used. Single and multiple strands—for all speeds.



The roller bearing path for power—Diamond Chain—between gasoline engine to saw mandrel on portable rig saw.

DIAMOND ROLLER CHAIN

ROLLING AT EVERY POINT OF CONTACT

CALENDAR OF MEETINGS AND EXPOSITIONS

March 12-14—

American Railway Engineering association.

Annual meeting and exposition to be held at the Palmer House, Chicago. E. H. Fritch, 59 East Van Buren street, Chicago, is secretary of the association.

March 18—

Engineering Uses of Modern Cast Metals.

Joint meeting of Western Society of Engineers, Chicago section of American Society of Mechanical Engineers and Chicago section of American Foundrymen's association to be held at the Engineering building, Chicago. Technical papers will be presented on the advances that have been made in gray iron, malleable iron and steel castings during the past few years. An exhibit of engineering applications of castings in many fields will be presented. A. M. Houser Jr., Crane Co., Chicago, is chairman of the meeting committee.

April 15-May 15—

National Alliance of Art and Industry.

Exposition which will include machinery and products designed for eye appeal will be held in the forum at Rockefeller Center, 30 Rockefeller plaza, New York. Information on the exhibit may be obtained from Thomas J. Maloney, 386 Fourth avenue, New York.

April 22-26—

American Chemical society.

Semi-annual meeting to be held at New York. Dr. Charles L. Parsons, 728 Mills building, Washington, is secretary of the chemical society.

April 22-26—

Knitting Arts Exposition.

Thirty-first annual exposition of machinery and products to be held at Commercial museum, Philadelphia. The exhibit is sponsored by National Association of Hosiery Manufacturers, Commercial museum, Philadelphia.

May 20-23—

National Association of Purchasing Agents

Annual meeting and information show to be held at New York. G. A. Renard, 11 Park place, New York, is secretary of the association.

May 23—

American Iron and Steel Institute.

Annual spring meeting to be held at New York. H. H. Cook, 1829 Empire State building, New York, is secretary of the institute.

June 17-20—

American Society of Agricultural Engineers.

Twenty-ninth annual meeting of the society to be held at the University of Georgia, Athens, Ga., will include technical papers on rural electrification, and on farm power and machinery. Raymond Olney, St. Joseph, Mich., is secretary of the society.

June 19-21—

American Society of Mechanical Engineers.

Annual summer meeting to be held at Hotel Gibson, Cincinnati, O. Clarence E. Davies, 29 West Thirty-ninth street, New York, is secretary of the society.

June 24-28—

American Institute of Electrical Engineers

Semiannual meeting to be held at Cornell University, Ithaca, N. Y. H. H. Henline, 33 West Thirty-ninth street, New York, is secretary of the institute.

June 24-28—

American Society for Testing Materials

Thirty-eighth annual meeting and exhibit of testing apparatus and related equipment will be held at Book-Cadillac hotel, Detroit. C. L. Warwick, 260 South Broad street, Philadelphia, is secretary of the society.

MACHINE DESIGN
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Speed Copes with Speed in Study of Design

By Floyd A. Ramsdell
General Manager, Worcester Film Corp.

and Albert Palmer
Assistant to General Manager, Crompton & Knowles Loom Works

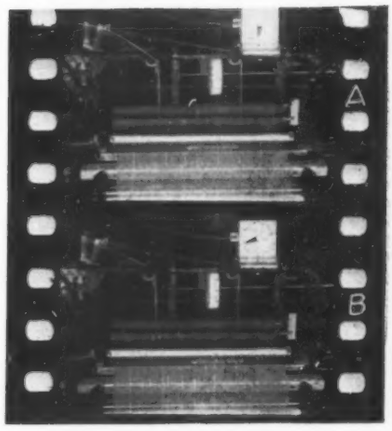


Fig. 2—Shuttle is immobilized in the course of its flight

TIME and space have always set the limits of human accomplishment. Speed, in one form or another, has been the weapon on which Man has chiefly depended in his conquests over these limiting factors. Now the speed of motion pictures is being employed to cope with the speed of fast moving parts of machinery of all types and in so doing provide the designer with data on the operation of the machines that prove invaluable in designing or redesigning a mechanism.

Incentive for new designs is created either by the advent of a new industry or by recognition of the manufacturer that only a radically improved machine will recreate the demand in an existing and changing industry.

Economic necessity, plus the rapid increase in the use of rayon, a synthetic yarn with characteristics differing materially from those of the

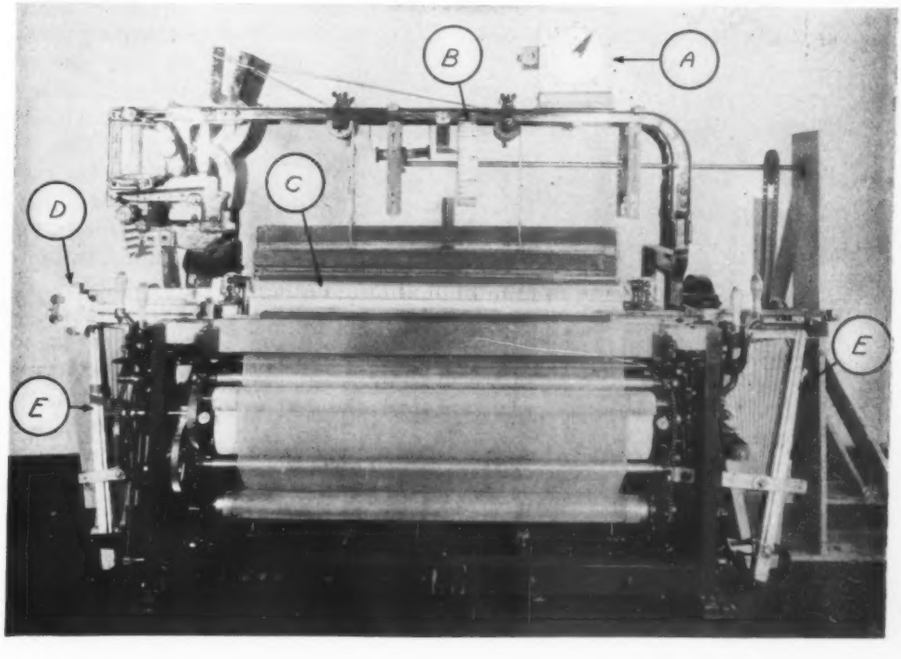


Fig. 1—Loom equipped with recording instruments to enable determination of exact position of parts from any single picture frame

natural fibers previously used, furnished the stimulus for a radical study to improve the weaving machinery made by Crompton & Knowles Loom Works. This study was undertaken to obtain information concerning the action of certain parts which have a great influence upon the success with which the loom operates. The procedure followed in this investigation can

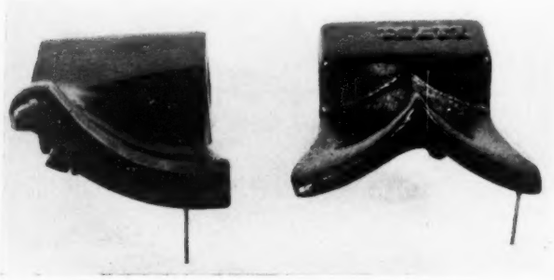


Fig. 3—Picking cam developed from motion picture study, left, replaced the former design, right

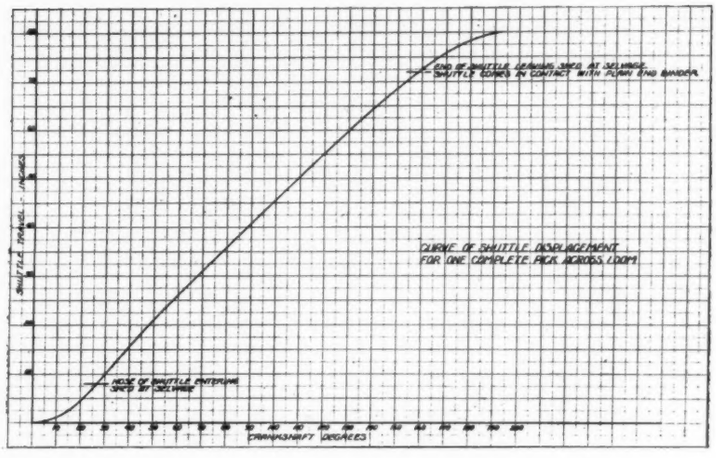
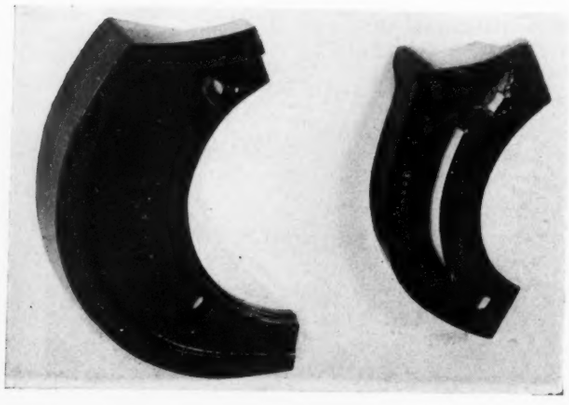


Fig. 4—Curve of shuttle movement vs. crankshaft degrees as determined from the film

Fig. 5—Another type of picking cam where detailed study of the machine enabled design of a new part, left



be used to advantage in studying equipment for other fields.

In a loom there are three mechanisms in particular, the proper co-ordination of which is essential. These are:

The picking motion which throws the shuttle.

The shedding mechanism which separates the warp threads to permit the passage of the shuttle.

The lay mechanism which performs the dual function of carrying the shuttles and of beating into place the thread of filling which is left by the shuttle after it passes across the loom.

If these mechanisms are not properly proportioned, or properly timed, both the quality and the quantity of fabric produced suffers. This is particularly true in the weaving of synthetic fibers.

In the early design of looms, rules of thumb resulting from experience were used to determine the relative positions of the mechanisms mentioned in the foregoing. Many attempts were made to check these rules by various mechanical and electrical devices. None of the methods tried, however, were very satisfactory, primarily because of the nature of the machine. Apparatus which depended upon physical contact with the shuttle was difficult to use because of the high speed and irregular movement of the shuttle. Stroboscopic equipment was practically useless because of the relatively low frequency with which the shuttle passes a given point in the machine.

For these reasons the decision was reached to take slow motion pictures of a loom in operation. Although popularly known as "slow motion," the camera which takes "slow motion" is in reality an ultra-speed device which does to motion what the microscope does to minute particles. It enlarges motion so that one may see the details of actions which at normal speed are invisible. It magnifies time, so to speak; but it does more. It makes a record of its magnified sequences so that they may be examined and studied again and again without recourse to the inspected machinery itself.

In fact, it is rather like setting a thief to catch a thief, for the ultra-speed motion picture camera uses its speed to capture the swiftness of moving objects. In analyzing action, it is not at all uncommon to take 200 successive pictures per second. This number of pictures must not

be confused with the length of exposure given each picture, which may be extraordinarily short. For example, this may be 1/5000 or 1/10,000 second, or even shorter—the chief limiting factor being that of illumination. Taken at the rate of 200 pictures per second, and projected for inspection purposes at the rate of 16 pictures per second, the speed of a mechanism is apparently "slowed" down to 1/12 of its actual speed.

The limitations placed upon slow motion picture analysis by lighting difficulties can be overcome. In the Crompton & Knowles study the pictures were taken at an average speed of 188 frames per second with an exposure of approximately 1/12,000 of a second. This extremely short exposure was necessary in order to make certain that the shuttle and timing mechanisms would be immobilized on each individual frame of the motion picture. Seventeen arc lamps drawing an approximate total current of 350 amperes at 110 volts, all concentrated on the particular part of the machine that was to be photographed, solved the problem.

Auxiliary Apparatus Employed

Fig. 1 shows the loom that was to be studied. For the purpose of the study it was equipped with auxiliary apparatus that is shown in the photograph. The time recording device *A* consists of a 1/100 horsepower, 1800 R.P.M. synchronous motor, to the shaft of which is fixed an aluminum disk, on which is painted a black arrow. By observing the movement of this arrow, the elapsed time could be computed.

B is a cylinder graduated in degrees which is driven from the crankshaft of the loom. This cylinder showed the exact position of the crankshaft at any given instant. *C* is a linear scale that was marked along the lay of the loom to indicate the number of inches traveled by the shuttle. *D* is a scale that records the position of the shuttle boxes and *E* two plain surfaces with radial lines against which the straightness of the picker stick can be compared.

These instruments enable the person analyzing the film to determine the location of all the essential parts of the loom at any given instant and to compute the time or distance from the last observation.

Despite the shortness of the exposure and the difficulty of lighting the shuttle as it passed through the warp, the film showed the shuttle immobilized in the course of its passage. *Fig.* 2 is enlargement of a typical section. It shows the movement of the shuttle from the drop box to the plain end of the loom with such clearness that each frame can be made the basis of individual analysis.

The chief value of a film of this kind is not from running it, but from turning it one frame at a time in a hand projector so that the position of the parts of the loom and the readings of the various instruments can be recorded. For example, in *Fig.* 2, by comparing frame *A* with frame *B* it can be computed that the shuttle moved 2 inches in 0.00533 seconds. In other words, the average speed of the shuttle for the 2 inches in question was 31.2 feet per second, or 21.3 miles per hour. During the time interval between frame *A* and frame *B* the crankshaft of the loom turned 4 degrees, and in frame *B* was 176 degrees from the position in which it was with the lay of the loom in the extreme forward position.

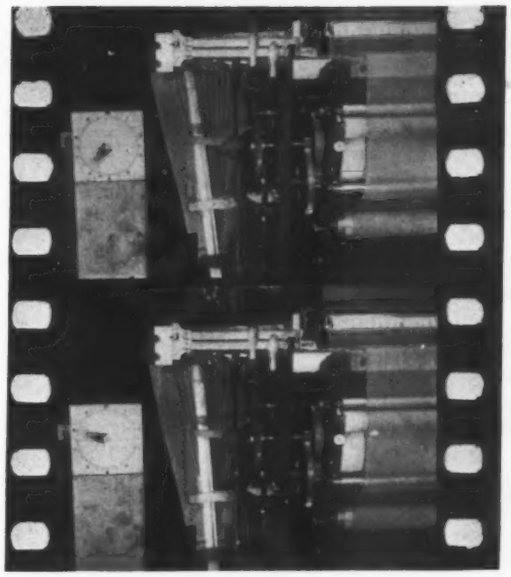


Fig. 6—Motion picture study revealed a distinct bend in the picker stick

This type of analysis disclosed a number of

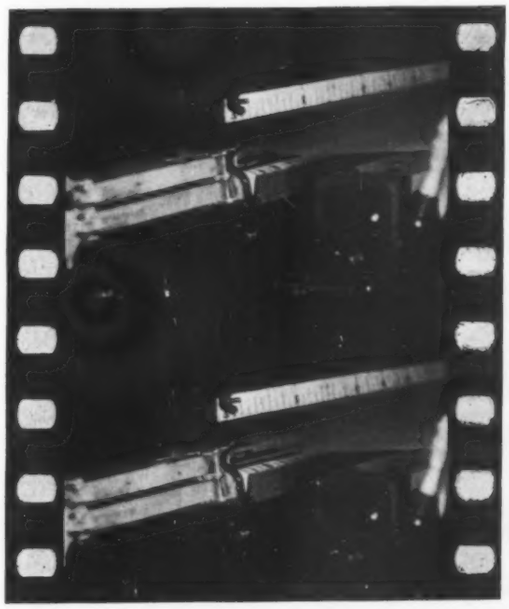


Fig. 7—Interference of the shuttle with the warp indicates need of redesign

interesting facts concerning the movement of the shuttle. *Fig.* 4 is a curve plotted from frame to frame, readings taken in the manner described previously. It gives shuttle travel in inches versus the degrees of crankshaft movement. The shuttle travel is measured from the drop box end of the loom with the shuttle moving toward the plain end of the loom. From this curve and other additional data, the speed of the shuttle at any point in its movement along the lay of the loom can be computed. For instance, at the time that the nose of the shuttle is entering the selvage on the drop box side of the loom, the speed is 38.7 feet per second. Half way across the loom it is 32.3 feet per second. Leaving the opposite selvage it is 25.6 feet per second. In other words, the velocity of the shuttle leaving one selvage is approximately 2/3 of the velocity at which it enters the oposite selvage.

Redesigned Cams Obtained

Figs. 3 and 5 show picking cams, used for throwing the shuttle, that were developed as the result of these studies. Prior to the taking of the pictures, formulas for computing the contour of these cams were developed from the fundamental equations of motion derived by the application of calculus to the problem. After the pictures were taken, a number of assumed constants were corrected. Of these two types of picking cams, the one pictured on the left in each instance is the new cam resulting from the development work, and the one on the right is the old one. While the photographs reveal no particular difference, there is a vast change in the new part as compared with the old part. The new one was made through a series of processes starting with the experimental data accumulated as described in the foregoing. After the characteristic curve for the shuttle movement was obtained, the pitch line of each cam was determined by a complicated drawing process. A development of the pitch line then was transferred to a thin steel templet which subsequently was placed in specially designed machinery that in turn generated the complicated surface along which the cam roll traveled in the course of its work.

An interesting sidelight on the picking motion of the ordinary loom is given in *Fig.* 6. The two frames of this figure show the loom in operation just as the shuttle is being picked out of the shuttle box. By comparing the straight line on the picker stick to the straight radial lines on the shield behind it, a perceptible bend in the stick can be seen. This explains why mathematically developed picking cams do not work, unless the designer has access to experimental data such as have been described in this article. The properties of a picker stick are similar to those of a golf club. The resilience of the stick contributes to the velocity of the shuttle.

The people who made the metal picker sticks tried to put them on looms in which the cams by experience and the trial and error method had been developed for wooden picker sticks. The correct manner in which to proceed on a job of this kind is for the manufacturer to make his picker stick and for the loom designer to design a cam to go with the resilient properties of the material in question. The only way in which the designer can acquire information of this sort is to obtain data and curves such as were computed in the case of the motion picture analysis which is under discussion.

A fact well known to mill men is that warp breakage tends to be concentrated on the selvages of the cloth that is being woven. This difficulty is largly the result of interference between the shuttle and the warp as the shuttle enters and leaves the shed, especially in looms where the mill operatives have failed to hang the harnesses correctly. The result of such faulty adjustment is shown in *Fig.* 7. Here are two views from the motion picture film showing the shuttle as it enters the selvage on the drop box side of the loom. The interference between the shuttle and the warp can be seen clearly.

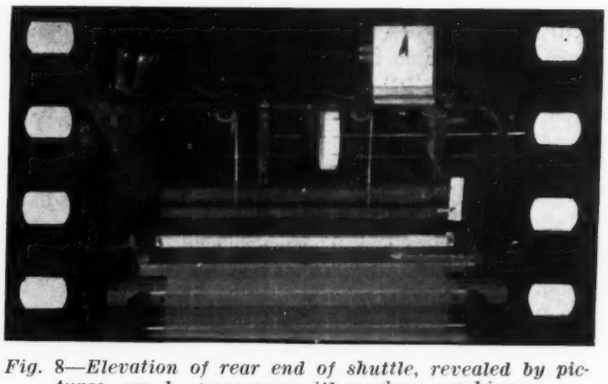


Fig. 8—*Elevation of rear end of shuttle, revealed by pictures, can be overcome with modern machinery*

Fig. 8 is an interesting view of the shuttle leaving the salvage and entering the plain end box. It illustrates how the shuttle is raised from the level of the race plate upon which it runs when the bottom part of the shed through which the shuttle passes is not kept close to the race plate, either through the fault of the loom fixer in hanging the harnesses, or through the characteristics of the mechanism which operates the harnesses. This difficulty can be and has been corrected by proper instruction on the part of the mills, and by improved design on the part of the machinery manufacturer. This picture shows the value of a suitable shuttle guide by which to prevent damage that, without it, would occur as the shuttle speeds on its way into the box under the conditions of adjustment here illustrated.

Fig. 9 contains a series of views taken from a position above the loom. They show the shuttle

entering the plain end box, and illustrate the manner in which a properly shaped binder gradually reduces the speed of the shuttle from the velocity at which it leaves the selvage to zero velocity. It shows at the same time how the shuttle in entering the box moves the binder to operate the so-called "protection" mechanism.

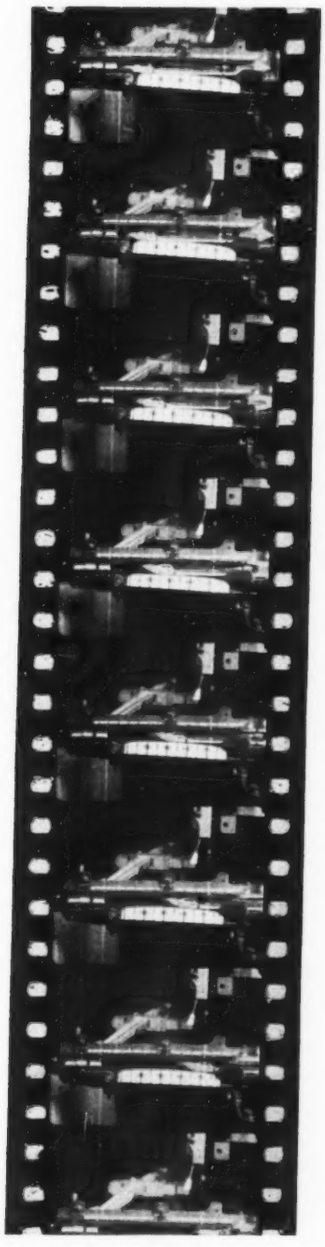


Fig. 9—A complete record of the shuttle entering the shuttle box is given by film

Reference to *Fig. 4* gives concrete evidence of the gradual retarding of the shuttle. At the upper end of the curve is a mark showing the point at which the end of the shuttle leaving the shed comes in contact with the plain end binder. From that instant the velocity of the shuttle gradually is reduced to zero. The characteristic of a loom which makes this gradual retardation possible is most desirable in weaving, because it minimizes the rebounding of the shuttle. If the shuttle enters the shuttle box without having its velocity gradually reduced, the impact with the stop at the end of the box causes the shuttle to rebound. This situation is undesirable because the filling yarn loses its tension, with the result that an imperfection may appear on the cloth, particularly if it be a rayon fabric. The gradual reduction in velocity is essential also to long life of such parts as pickers and picker sticks, to say nothing of the shuttle itself.

The use of the slow motion picture as a basis for redesigning the loom is typical of the many uses to which the slow motion picture can be put in the design of machinery. For example, a type of "pulling over" machine used in the manufacture of shoes had been giving trouble for years. This machine has a group of fingers on each side which grasp the upper leather, pull it over the wooden last and hold it there. At this point two plungers (one on each side) come down and drive tacks into the last through the edge of the upper leather, holding it in place. At slow speed this machine worked satisfactorily, but at production speed it would occasionally drive tacks into the visible part of the upper leather.

The motion of the parts at production speed was too rapid for the eye to follow. The part suspected of causing the trouble moved so rapidly that it seemed not to move at all. Like the intermittent sprocket on a motion picture projector, it appeared to stand still.

Error in Design Discovered

While the shoe machine was running at its normal production speed, it was photographed with an ultra-speed (slow motion) camera. On the screen the motion of the two plungers, which had been supposed to be coincident, was found to be far from it. One plunger actually lagged behind the other until the first had driven tacks into the shoe just as the other was starting down. Engineers who saw the film immediately recognized the cause of the trouble and were able to correct it.

In a steel mill flying shears were cutting sheet bars at the wrong length and in spite of careful observation engineers were unable to determine the cause of the trouble. This was partly due to the speed at which the steel traveled (700 feet per minute) and partly because of the fact that it was impossible for the eye to concentrate on more than one part of the mechanism at a time.

The slow motion camera immediately solved the problem. A study of the picture showed that in dropping to the distribution table after being cut by the flying shears, the sheet bar overlapped the edge of the table and the drop was sufficient to cause a bend in the hot steel. This bend occasionally was of sufficient height to trip the mechanism which operated the shears, causing the next cut to take place at the wrong time.

It was at once evident that the only thing necessary to correct the trouble was a small steel apron in front of the table to prevent bending.

From the illustrations which have been mentioned, it is evident that the slow motion camera has the dual advantage of taking simultaneous readings of a number of correlated instruments, and enabling an accurate observation of parts that are moving too rapidly to be seen by the unaided eye or too infrequently to be seen with a stroboscope, by recording them in a form which later can be studied and analyzed either as motion pictures or still pictures. It adds a new power to scientific investigation which is the foundation of progress in modern design.

SCANNING THE FIELD FOR IDEAS

TRANSMITTING PHOTOS ELECTRICALLY

MECHANICAL and electrical devices have been linked together by engineers to provide the newspaper industry with an epochal development . . . the wirephoto as it is called in newspaper parlance. At the turn of the year a telephotograph system was completed by which papers that are hooked into the network can give their readers a photographic record of an event in a comparatively few minutes after it happened thousands of miles away. The following discussion while necessarily lacking in certain technical details is presented to place emphasis on the value of an idea that takes its roots from several phases of engineering.

It is not surprising to see that the photoelectric cell is an essential factor in this development. The general method employed in picture transmission, the *Bell Laboratories Record* points out, consists of analyzing or scanning in successive elements an area containing graphic information such as photos and converting such information into some characteristic of an electrical current as a function of time. The resulting current then is transmitted by wire to the receiving equipment where a process inverse to that employed for sending is used to reproduce the information in substantially the original form. Equipment for carrying this out is shown schematically in *Fig.* 1.

A photographic print to be transmitted is wrapped about a cylinder connected through a clutch to a constant speed motor. While this cylinder is rotating, the carriage on which the optical system is mounted is moved along the bed of the machine by a highly accurate lead screw geared to the rotating cylinder. A close-up view of the carriage of the transmitting machine is shown in *Fig.* 2. The photoelectric cell can be seen through the circular opening.

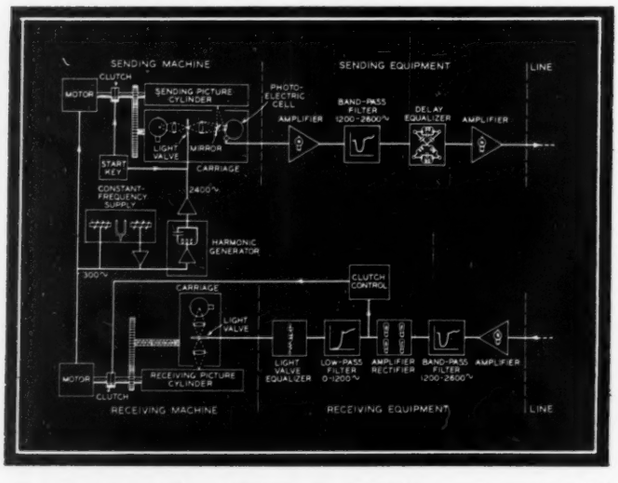


Fig. 1—*Schematic diagram of electrical and mechanical devices embodied in sending and receiving equipment*

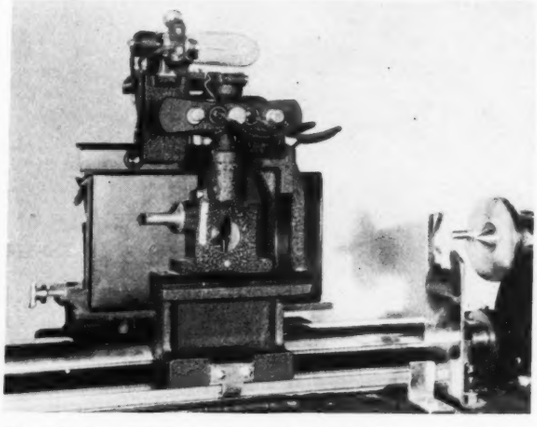


Fig. 2—*Close-up view of the carriage of telephotograph transmitting machine*

As the optical unit advances parallel to the axis of the cylinder one-hundredth of an inch for each revolution, a pulsating beam of light rectangular in cross section and one-hundredth of an inch wide, scans the picture area in successive parallel paths. This pulsating light, modulated by reflection from the picture, is directed to the photoelectric cell and is carried to its destination as a series of electrical impulses. The receiving equipment employs equipment similar to that for sending, except that the receiving cylinder on which a negative film is mounted, is enclosed in a housing to exclude light other than that from the optical system. Driving motors are allowed to run continuously, being disconnected from the picture cylinders by a magnetically controlled clutch.

This innovation is a significant step in design

which has taken advantage of electrical and mechanical experience, even to the extent of embodying the idea of the lathe in working out the lateral movement of the optical equipment.

HARD FACING REDUCES WEAR

ELIMINATION of wear on thrust rings for roller bearing installations is one of the uses to which hard facing material—in this case Stoodite—has been of assistance to engineers. When this application first was considered the intention was to surface the entire face of the ring with the material and grind the weld-

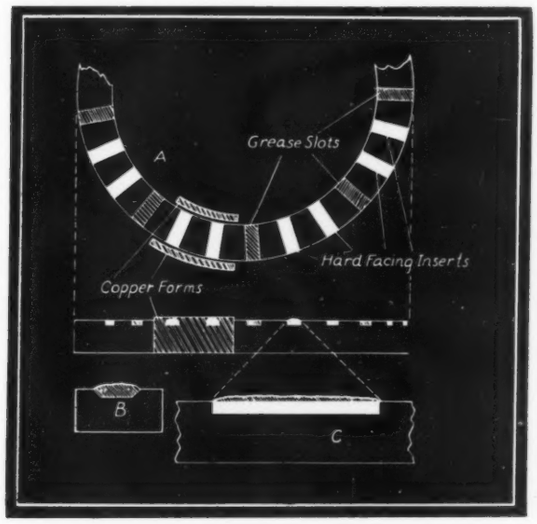


Fig. 3—Inserts of hard facing material obviate wear on thrust rings for roller bearings

ed surface to the proper finish. In experimenting, however, inserts were found to work as well and in addition they reduced the cost.

Inserts are made by planing or milling grooves across the face of the ring, *Fig.* 3, *A*. On the first rings to undergo this procedure a groove with square shoulders (sketch *C*) was employed, but tests revealed that better results could be obtained by relieving the corners of the groove and cutting it out as shown at *B*.

If the ring contains grease slots the grooves containing the hard facing material are spaced between them. Grooves may be cut from ⅛ to 3/16 inch deep and from ¾ to 1¼ inches in width. Each groove may run entirely across the face of the thrust ring as shown, or may extend only part of the way across the face, leaving a wall of original metal on the inside of the ring. The object in cutting the groove only part way through is to eliminate the possibility of the hard facing metal projecting over the edges of the ring, making it necessary to grind the inside as well as the face of the ring.

Use of forms made of copper plate will, however, obviate any difficulty inasmuch as they serve as dams at both ends of the slot. The hard facing metal does not adhere to copper. Stoodite is used with the metallic arc and is deposited in the groove. Either bare or coated electrode may be employed. Best results, however, are obtained with the coated electrodes due to the fact that some undercutting is found on the groove edges when deposits are made with bare electrodes.

CENTRIFUGAL FORCE GOVERNS SPEED

ANOTHER way of utilizing centrifugal force is disclosed by the design of a speed governor employed on a prominent oxyacetylene cutting machine. The device, *Fig.* 4, is mounted on the armature shaft of a motor *A*, adjustment being effected through knurled knob *B*.

Two contact points *C* and *D* are mounted on the ends of separate parallel flat springs attached at their opposite ends to two brackets which in turn are fastened to a disk of insulating material. On the opposite side of the disk are mounted two concentric collector rings, each of which is connected electrically to one of the springs and its contact point.

Circuit through the governor is from one collector ring, to the contact points and back to the other collector ring. The governor is connected in series with the motor circuit through the two brushes *E* and *F* which make contact with the inner and outer rings, respectively.

The inner spring *C* is connected by link *H* to one end of a bellcrank lever *J*, pivotally mount-

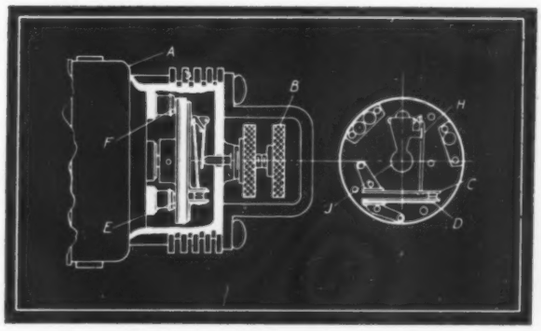


Fig. 4—Centrifugal force acts on contact points to control speed of motor

ed on a bracket fastened to the governor disk. The free end of the lever *H* is enlarged to form a contact surface for the end of the speed adjusting screw. Contact points *C* and *D* are in effect small weights mounted on the free ends of their springs. Since their location is at some distance from the center of rotation the influence of centrifugal force while the motor is running tends to deflect the springs toward the outer edge of the governor disk.

In operation the outer spring and contact point *D* move outwardly. Inner spring and contact *C* tend to follow and keep the contacts closed, but in so doing the enlarged end of the

bellcrank lever *J* is moved axially until it comes in contact with the end of the speed adjusting screw. This prevents further travel of the inner contact point and the circuit is broken. When the current is interrupted the motor slows down, whereupon the outer spring at reduced shaft speed moves toward the inner contact point until contact is re-established and the cycle repeated.

The shaft speed at which the governor functions is of course determined by the setting of the speed adjusting screw *B*. The operating cycle takes place at a frequency of approximately three hundred current interruptions per second, thereby affording an unusually accurate speed control. The Tractograph, a portable hand-guided oxacetylene cutting machine developed by Air Reduction Sales Co., utilizes this speed governing device.

RUBBER DELIVERS TORSIONAL IMPACTS

BECAUSE a cylindrical block of rubber when twisted becomes shorter and in so doing stores energy, the designers of an impact wrench for tightening or loosening nuts were able to utilize this material in carrying out a clever idea. In the tool the rubber member is known as an accumulator designated *A*, *Fig.* 5, and is interposed between an air motor and a chuck.

In operation torque from the motor is applied to the rubber accumulator which, in becoming shortened through twisting, lifts the hammer *B* from engagement with anvil *C*. As soon as the hammer is released the untwisting of the rubber block spins the hammer forward to the next engagement, thus delivering a powerful twisting blow to the anvil, on the end of which the chuck is attached.

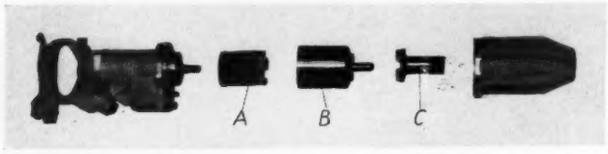


Fig. 5—A cylindrical rubber block or accumulator A exerts torsional impacts that act on chuck of wrench

These torsional impacts, occurring at the rate of 1200 to 1400 blows a minute, exert a powerful turning effect. One man operates the wrench with ease, the accumulator absorbing the torque and eliminating the danger of shock or injury to the operator. This impact wrench is manufactured by Ingersoll-Rand Co.

CRUSHER EMPLOYS ROLLING RINGS

A SIMPLE yet interesting idea is employed in a new crusher, *Fig.* 6, the principle being based on what are called rolling rings. A number of these manganese steel rings suspended from a shaft, are controlled by centrifugal force and grind by impact with the material handled by the crusher. The fact that the rings can be thrown back four inches when they encounter noncrushable material is an important feature. This flexibility protects the mechanism against pieces of iron or other tramp material. American Pulverizer Co. developed the machine.

AUTO AND AIRPLANE TRADE IDEAS

WHEN Wm. B. Stout makes a prediction the engineering fraternity listens with intense interest. One of his more recent forecasts published in the *Michigan Manufacturer and Financial Record* is worthy of thought. Says Mr. Stout: "Aviation and automobile engineering are coming closer together. Eventually they will meet. When they do, automobiles will fly or conversely airplanes, with their wings shed or folded temporarily, will run through the city streets. This day is coming just as surely as we now have radio, television and other accomplishments which twenty-five years ago appeared just as impossible.

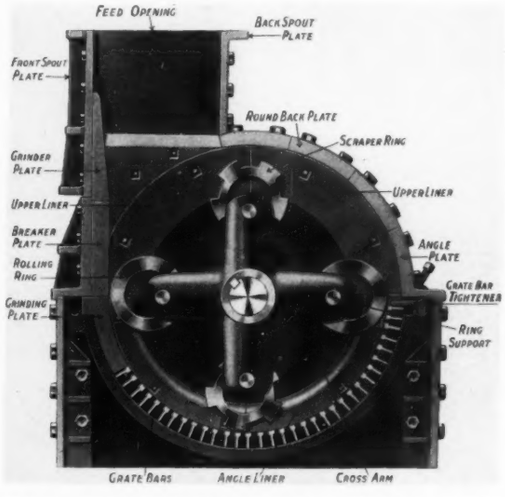


Fig. 6—Rolling rings in crusher grind by impact and protect mechanism against tramp material

"One of the truest signs of the converging of the airplane and the automobile is the extent to which each of the two industries is drawing upon the other in current practice. In the early days aviation drew heavily in man power and ideas from the automobile industry. Today the pendulum is swinging the other way. The coming automobiles will borrow heavily from aviation as regards streamlining, vision, marked reduction in weight, greater use of aluminum and other light alloys, greatly increased power ratio —getting down to something like fifteen pounds per horsepower—and I would not even be surprised to see something like an airplane landing gear used in place of the present type of automobile spring suspension."

Fig. 1 — This manually-operated ironer is capable of applying 400 pounds pressure automatically between ironing head and board

Utilizing Stored Energy in Mechanical Springs

By William M. Emery

STORED energy in springs can be utilized to produce high pressures with only enough applied force to overcome frictional losses and overbalance the movement of certain associated parts of a mechanism. With proper balance an inverted pendulum oscillating between two opposing compression springs will continue to oscillate for a long interval incident to the alternate transference of stored energy from one spring to another. A practical example of this is found in the Scot-Ironer, *Fig.* 1.

The heated pressure head is brought to bear against a resiliently mounted ironing board by means of spring forces acting through a pivotally mounted cam and roller. The cam is so generated that the actuating spring forces released at each point of the movement are adequate to overbalance the resisting or reacting forces set up in the resilient mounting of the ironing board. The actuating spring forces automatically apply 400 pounds pressure. Relief of this pressure is effected by manually applying sufficient force to overbalance the spring force and to overcome friction. Thus like the spring-actuated pendulum previously mentioned the pressure-applying forces are transferred back and forth without dissipation, except frictional losses, between the actuating spring and the resilient mounting of the ironing board.

The iron pressing head *A*, *Fig.* 2, is a reinforced aluminum casting pivoted to a C-shaped support arm *B*. A significant feature is embodied in this member. The designers desired an arm capable of taking 500 pounds strain without a permanent set. In addition, the arm needed to be ornamental. Two identical stampings welded together solved the problem of forming the ornamental longitudinal lines, of flanging a C-transverse section and of curving this into a goose neck, all at minimum die expense. The two halves of the arm are reversible, and a strip is welded over the seam to harmonize with the ornamentation of the ironer. In order to stiffen the arm so that it will retain its shape, an initial set of $\frac{5}{8}$-inch, equivalent to an 850-pound strain, was imparted to it.

Deep Drawn Sheet Cam Utilized

To the lower end of arm *B* is welded a bracket *C* through which passes a shaft to connect the bracket pivotally with a channel-shaped radius arm *D*. Welded to this arm *D* is a carefully generated cam *L* made of deep drawing sheet and case hardened. The lower end of the arm *D* is journaled on a spacer tube *E* clamped between the housing members by a bolt.

In the upper portion of the bracket *C* is a ball bearing roller *F* which operates on guide tracks

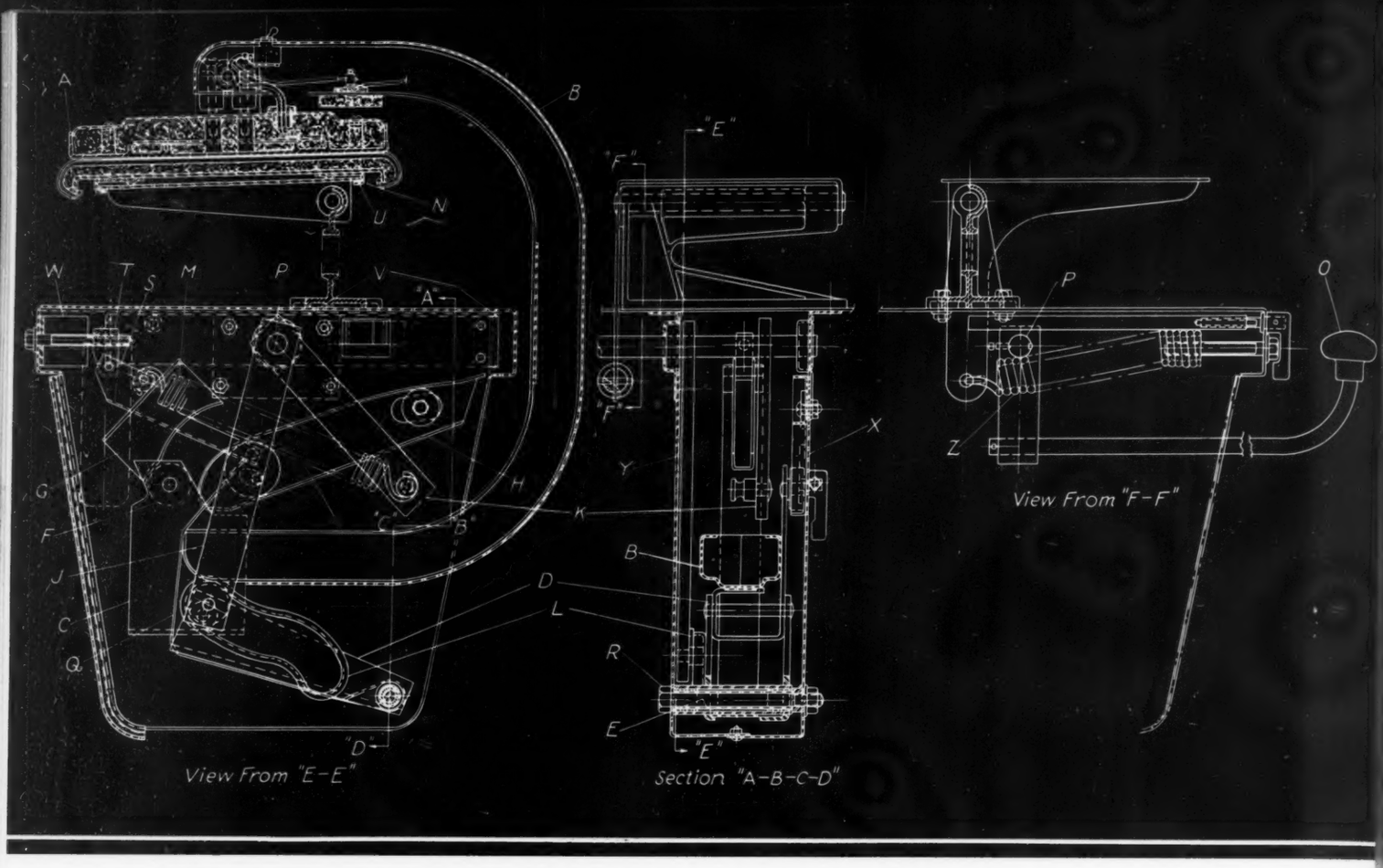


Fig. 2—Diagrammatic views of operating mechanism show, at left, the expansion spring M by which pressure is applied. Spring Z provides resiliency and means of adjustment for the ironing board

G and *H* that are generated to cause the head of iron *A* to raise from the ironing board *U* and then recede horizontally until the ironing board is uncovered.

Mounted in ball bearings in two plates bolted to the housing is a shaft *P* on which is keyed a bellcrank *J-K*. A roller on the longer bellcrank arm *J* operates in cam *L*. While a heavy spring *M* operating under a strain of about 350 pounds is attached to the shorter bellcrank arm *K*.

In the position of the parts as shown in *Fig.* 2, pressure has been applied by stored forces in spring *M*, and incident to the application of pressure various parts of the frame such as arm *B* and the head spring *N* have been temporarily distorted, thereby storing resisting forces in them equal to about eighty per cent of the forces expended by spring *M* in the application of the pressure.

To open the press the operating handle *O* is depressed 6½ inches. This requires little effort considering the amount of pressure produced because the forces stored in the stressed parts are restored back initially into spring *M*. As shaft *P* is further rotated to place the ironer in full position, by operating handle *O*, crank-arm *K* assumes a position such that spring *M* operates at practically dead center and the roller in cam *L* is in such a position in the cam that only a small force is expended from the spring.

In the pressing operation, to counterbalance the forces during the final drop of the head or iron *A* toward the board there is provided a steel band *Q* which is bolted around pivot shaft *R* and passes around the front ends of radius arm *D* and support arm *B*; the band is anchored to a stamped lever arm *S* to which also is attached spring *M*. Forward end of arm *S* is pivoted in a small block *T*.

A knee-controlled catch *V* engages a point on the bracket *C* when the press is open and holds it so. Responsive to a touch of the knee control latch, the pressing head moves over the ironing board and drops gently into pressing contact.

Outer Housing Stamped and Welded

Welding as mentioned earlier plays an important part in the design of this ironer. The outer housing of the unit discussed in the foregoing is composed of two stamped pans, each flanged on four sides. An ornamental front section then is spot welded to the pans as well as to a brace *W*. Subsequently, the complete housing is spot welded to the flanged table along the upper and outwardly extending flanges *X* and *Y*. Brace *W* is welded to the front flange of the table.

When the machine is completed the flanges at the bottom of the housing are bolted together; thus the housing becomes a rigid five-sided box, with only the back open. Welding of the housing to table appreciably stiffens the latter.

Designing for Appearance

Part II

By Harold L. Van Doren
Van Doren & Rideout, Toledo, O.

INDUSTRIAL design, as opposed to textile design, arrangement of component parts of an advertisment, etc., is almost always a matter of three dimensions. If the fundamental masses of a design are harmonious, the decoration of flat surfaces may enter into the picture as a minor consideration. But mass is all-important. Some fundamentals of rhythm, proportion and space division in the flat were discussed in the February issue of MACHINE DESIGN. In the present article we shall deal chiefly with the manipulation of masses in three dimensions.

The principles involved are analogous, but their application to three-dimensional forms is a much more ticklish question and one which requires a different kind of mental visualization. It is unfortunate that the majority of engineers do not practice constantly the free-hand drawing they are taught in the schools. They have accustomed themselves to thinking orthographically and have lost the faculty of visualizing in perspective, and of translating their ideas into free-hand, shaded sketches.

Perspective Sketches Valuable

Facility in free-hand perspective sketching is virtually indispensable to the designer. A well-planned isometric is sometimes a help, but it cannot replace perspective. The plan, elevation and side views of an object may each be perfect in itself, and yet the entire design may completely lack Unity.

For example, let us take a diagram used in the preceding article. If you will remember, we showed a rectangular shape known as the "Golden Rectangle" of Leonardo da Vinci. It was produced by bisecting a square, drawing the diagonal of half the square, and producing this diagonal along the bottom line, as follows:

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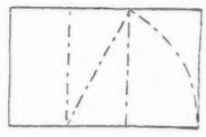
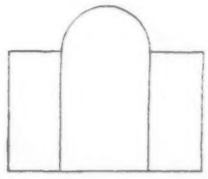


We then divided it into agreeable spaces, and added to the central section a semicircular piece. We felt that this addition called for slight expansion of the "wings" on either side. The resulting shape was this:

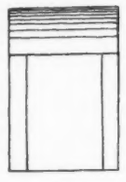


As an example of balanced design in two dimensions, it is unimpeachable. It will be found in one modification or another throughout the history of architecture: In triumphal arches from Roman times, in window groups from the Renaissance, in formal interiors. Paintings, usually altar pieces, executed in this general shape are known as "triptychs," and may be found repeated thousands of times in the religious art of Italy, France, Germany and Flanders. The central area makes an ideal frame for a standing figure of the Virgin, the customary groups of saints being depicted in wings.

This arrangement derives its dignity and impressiveness from the fact that it has "formal balance"—a central dominating or accented shape, flanked by minor shapes of different proportions. No one of these shapes alone would be of particular interest, but together they have all

the elements of good design—Rhythm, Balance, Variety, Unity.

Now we will turn this at right angles and draw the side view, letting the total area make another good rectangle as shown herewith. Since both elevation and side view are based on beautifully proportioned rectangles, the resulting design should vie with the Parthenon in the perfection of its proportions.



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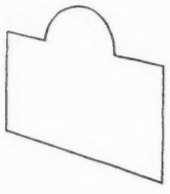
Let us now swing this flat shape into perspective, as if it still had but two dimensions, its thickness still being theoretical, or, if you will, the thickness of a sheet of paper:



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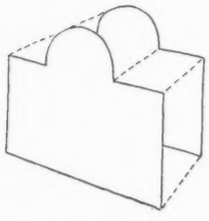
Now we shall push the entire shape back into space at 90 degrees, until its side has assumed the proportions called for by the side view. Then we shall shade it:



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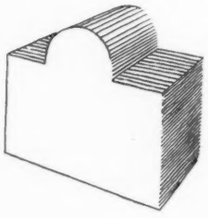

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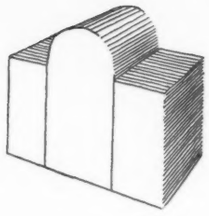
The result is somehow disappointing. For one thing it is pretty bare, proving that a shape which may be interesting in the flat may not be particularly effective when projected into deep space. Now that our design is shown as a solid, the problem has assumed a different aspect.

Another reason is that the vertical lines, which satisfactorily divided the flat shape, No. 2, into three varied areas, are no longer of any use to us when we throw it into *mass* seen in perspective. We have eliminated them purposely, because, now that we are dealing with three-dimensional form, we must get rid of all purely two-dimensional aspects and think in terms of solids. At best, these lines could only be included in the design as ribs, or beads, or painted stripes, and they would count for very little. See for yourself:



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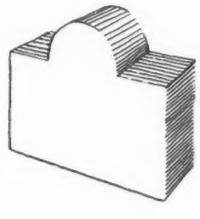
Further, we discover that our "Golden Rectangle," which we know to be a beautifully proportioned rectangular area, has completely disappeared in the perspective view, and at the end of the wing we now have an area which is almost a square, but not quite; and, if we have learned our lesson from the preceding article, an "almost" square shape is to be shunned as the plague. In fact, it was quite useless for us to attempt to make the side view, No. 3, another Golden Rectangle because the draftsman's "side-view" of any design is a purely arbitrary conception. Visually it is nonexistent, although it is a very convenient way of working on the drawing board.

Should Visualize Design

Very few people have sufficient powers of visualization to "see" even a fairly simple design in their mind's eye when confronted with the usual elevation, side-view, and plan. That is why the architect shows the home-builder a perspective sketch, and why the industrial designer shows his client a perspective rendering or a model. Of course if the only function of the designer were to make perspectives of already existing designs, it would be folly to engage him, for anybody can "bone up" on perspective from a book. The designer must be able also to manipulate shapes, to think in terms of forms seen in mass rather than in line.

But to return to our design. We have been worried about its bareness as it appears in No. 3, and about that "almost square" shape at the end of the wing. We might resort to the device of changing the square to a more agreeable rectangle. Let us try the "golden" once more:



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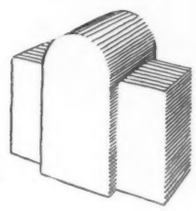
Perhaps we have improved matters somewhat. We have been forced to narrow up the whole design, but there is nothing actually wrong with the result. It is narrower, that's all. The real trouble is, we are still thinking in the wrong

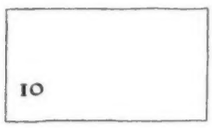
way. We are modifying small parts of the design, a side at a time, without regard for the whole. We shall have to take the bit in our teeth and let that dominant central motive *really* dominate the whole design, but do so in three dimensions as well as in the flat. We can do this by returning to No. 6, and pinching in the flanking wings, thus:



9

Now, gentlemen, we have begun to visualize in three dimensions for the first time! Hitherto we have taken only hesitant steps. But now we are manipulating masses rather than lines—the all-important step. By this change we have accomplished several objectives. We have broken up the flat mass of the front so that it ceases to look quite so bare. We have increased the dominance of the central mass, thus giving accent and rhythm to the form. Automatically, we have forced that squarish shape on the end to become a more positive rectangle, without changing the depth of the central mass originally established in No. 6. We have broken the straight base line, and have produced a varied line possessing far more interest, one which changes constantly as the position of the spectator changes.

In fact, if we now drew a plan view of the object, we would find that by manipulating the *mass* we had also unwittingly given point and style to the *plan*. That is, in place of a single rectangle, we now have two intersecting rectangles:



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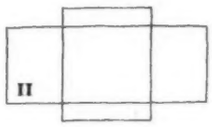


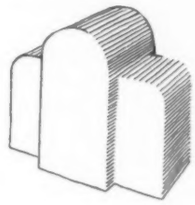
11

You will note also that the masses have been manipulated so that, in effect, we have a central vertical mass of distinctive shape actually penetrated by another mass utterly different in shape, consisting of a rectangular prism, the end of which we can make a Golden Rectangle if we so desire:

12

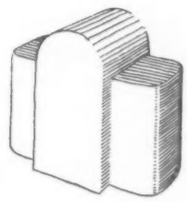
At the risk of seeming repetitious, let me again point out that we are now thinking in three dimensions, an absolute requisite for industrial design. The simple step of pinching in the wings has liberated our imagination and opened up unexpected vistas. Now we can let ourselves go and play with dozens of different ideas that occur to us.

For one thing, we notice that the horizontal mass is rather harsh and uncompromising compared with the gentler vertical mass which it penetrates to form the wings. We might round it off in the vertical plane, as follows:



13

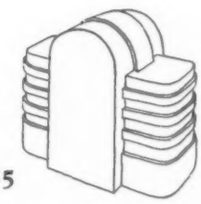
This is not entirely satisfactory, however, for it only succeeds in giving the same vertical feel to the wings, and repeating the curves of the central mass. It is all right, but there may be some other and better way of accomplishing the result. Let us round the mass off in the horizontal plane instead:



14

Much better. For one thing, we have more contrast, more variety. We are now treating the two masses as they should be treated, namely, as well-differentiated but entirely harmonious forms.

We may wish to emphasize the horizontality of one and the verticality of the other by further embellishment:



15

We could go on indefinitely altering and refining these forms, but this brief demonstration should be sufficient to point the way. Intentionally I have chosen an abstract shape, without reference to what sort of product it might be. In actual practice we would probably have much

less freedom than this, due to dozens of limiting factors. But it is sometimes astonishing how the ingenious designer will find ways and means of manipulating the form elements of a given machine or part even under difficult limitations.

At that, if we use a little imagination, it would not be hard to supply in the mind's eye a dial and hands, and think of our design as a mantel clock. Or it might be the housing for an oil conversion burner for furnaces, or a molded plastic box containing a manicure set for the dressing table.

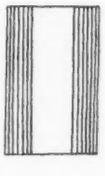
In a forthcoming article we shall show how the method of approach here suggested can be applied to actual production problems.

Co-operation Is Necessary

The old saw that you cannot make a silk purse out of a sow's ear goes for industrial design as well as many other things. Occasionally a manufacturer expects the designer to recreate a machine or product, then takes a fiendish delight in pointing out that nothing must be changed. Of course such obstacles are insurmountable. Radical redesign requires wholehearted co-operation on the part of plant executives, engineers and designers. Real results cannot be obtained in any other way. New tools and dies, jigs and fixtures cost money. True, but many times the investment has proved worth while, a thousand fold.

Before closing it may be well to discuss briefly another matter. It can be demonstrated in two dimensions as well as in three. Every designer uses lines, forms and other elements purposefully, to accomplish certain preconceived ends. He knows how to make the spectator's eye do his bidding. He does not always have a free hand to force the material with which he is working into the most pleasing shapes. More often than not the raw material is awkward and difficult. A given rectangle may be too long to be a pleasing or easily divided rectangular shape, and yet not long enough to become a mere *band*. On the other hand, it may approach too closely to a square to be agreeable, as previously discussed.

If such is the case, the designer has at his command certain resources to trick the eye into seeing the shape as a form which it is not. One of these resources may be demonstrated, in the manner of the "optical illusions" in Sunday supplements, by dividing two identical rectangles with lines in opposite directions, thus making them appear totally different shapes:



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17

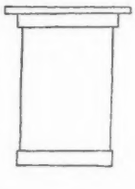
There are many optical illusions which the designer may legitimately use when the conditions are such that the main masses cannot be given the ideal proportions.

The Greeks were masters of the art of visual deception. A Greek temple that may appear quite formal and regular will embody dozens of subtly refined irregularities. Its rectangular plan is not rectangular at all, but each side is slightly bowed out to counteract the tendency towards concavity that ensues from geometrical regularity seen in perspective. Each column is swelled a little at about two-fifths of its height to avoid the "knock-kneed" effect produced by the two almost parallel lines of its sides. This device is known as "entasis." Many modern attempts to imitate the classic style exaggerate the entasis, making the column look actually swelled, whereas in the best Greek examples the swelling is so subtly done that the columns appear evenly tapered—the effect intended.

Material May Limit Design Steps

In attempting to apply such refinements to design, we are often checkmated by the material or the process. Entasis is practically impossible in working with sheet-metal formed on brakes, and is difficult and costly in stampings. It is more possible in casting or molding processes.

Modifications of the principle to achieve similar worthwhile effects can frequently be used, however. The position the spectator will assume in viewing the object is important. Let us suppose we are designing a cast-iron pedestal to support some machine, say a lathe, or, better, a saw with a flat working-table, waist high. If its sides are parallel, the bottom of the pedestal may look smaller due to the diminishing perspective of the lines as seen from the height of the eye in standing position. If we tip the lines in very slightly at the top, we can help to overcome this diminishing effect.



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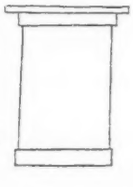

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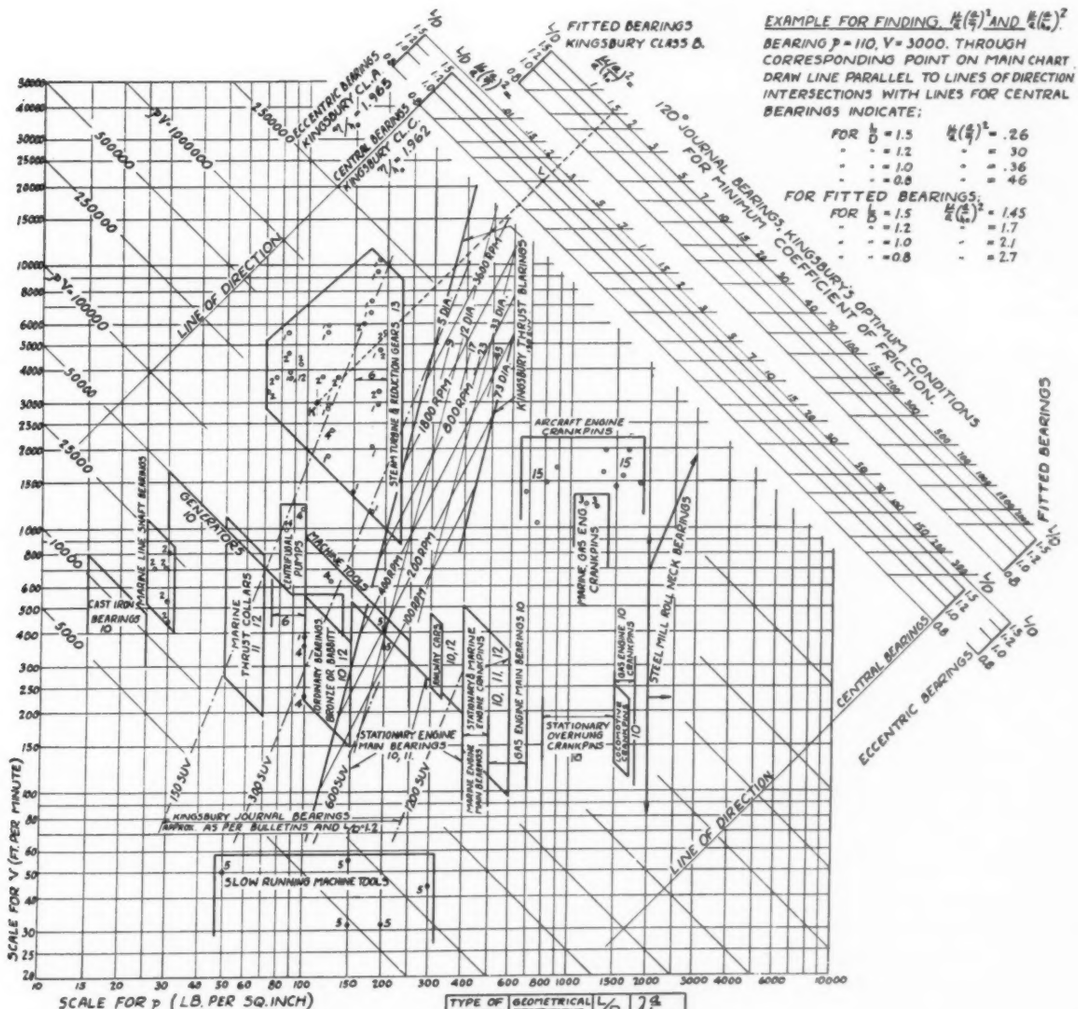
On the other hand, the effect of convergence in the parallel sides of a gasoline pump, where the height is greater than eye level when standing or when sitting in a car, would not be so noticeable, hence the lines might as well be left parallel.

Even the simplest problem demands careful consideration of many points which may seem like splitting hairs, but which actually spell the difference between success and failure in the final appearance of the product when it is ready for the market.

Comparing Theory and Practice for Bearings

TO DETERMINE present practice in pressures, speeds, clearances and lubrication of oil-film bearings, and to compare this with conditions that appear to be desirable from theoretical considerations, a poll has been made of manufacturers and users by H. A. S. Howarth, Kingsbury Machine Works, Philadelphia. The results of this poll and a general discussion of much of the data was presented at the recent meeting of the American Society of Mechanical Engineers. This paper included the following:

Because much of the older practice and some current practice is based on reference to the


FITTED BEARINGS KINGSBURY CLASS B.
EXAMPLE FOR FINDING $\frac{W}{2}(\frac{c}{r})^2$ AND $\frac{W}{2}(\frac{c}{R})^2$
BEARING P = 110, V = 3000. THROUGH CORRESPONDING POINT ON MAIN CHART DRAW LINE PARALLEL TO LINES OF DIRECTION INTERSECTIONS WITH LINES FOR CENTRAL BEARINGS INDICATE;
FOR $\frac{L}{D}$ = 1.5 $\frac{W}{2}(\frac{c}{r})^2$ = .26
" " = 1.2 " = 30
" " = 1.0 " = .36
" " = 0.8 " = 46
FOR FITTED BEARINGS;
FOR $\frac{L}{D}$ = 1.5 $\frac{W}{2}(\frac{c}{R})^2$ = 1.45
" " = 1.2 " = 1.7
" " = 1.0 " = 2.1
" " = 0.8 " = 2.7
120° JOURNAL BEARINGS, KINGSBURY'S OPTIMUM CONDITIONS FOR MINIMUM COEFFICIENT OF FRICTION.
LINE OF DIRECTION
CENTRAL BEARINGS
ECCENTRIC BEARINGS
FITTED BEARINGS
KINGSBURY JOURNAL BEARINGS APPROX. AS PER BULLETINS AND
SLOW RUNNING MACHINE TOOLS
MARINE LINE SHAFT BEARINGS
CAST IRON BEARINGS
MARINE THRUST COLLARS
GENERATORS
CENTRIFUGAL PUMPS
MACHINE TOOLS
STEAM TURBINE & REDUCTION GEARS
KINGSBURY THRUST BEARINGS
AIRCRAFT ENGINE CRANKPINS
MARINE GAS ENG. CRANKPINS
GAS ENGINE CRANKPINS
STEEL MILL ROLL NECK BEARINGS
STATIONARY ENGINE MAIN BEARINGS
STATIONARY OVERHUNG CRANKPINS
LOCOMOTIVE SIDE ROD CRANKPINS
SCALE FOR V (FT PER MINUTE)
SCALE FOR p (LB. PER SQ. INCH)

KINGSBURY'S OPTIMUM DATA; (CORRECTED FOR SIDE LEAKAGE)

TYPE OF BEARING	GEOMETRICAL CONDITIONS	L/D	$\frac{W}{2}(\frac{c}{r})^2$
CLASS A	C = 0.491	0.8	6.52
	$\frac{\alpha}{\beta}$ = 0.571	1.0	5.19
	$\frac{r}{R}$ = 1.965	1.2	4.47
		1.5	3.87
CLASS B	$\frac{\alpha}{\beta}$ = 0.646	0.8	7.60
		1.0	6.05
		1.2	5.21
		1.5	4.51
CLASS C	C = 0.490	0.8	7.64
	$\frac{r}{R}$ = 1.962	1.0	6.24
		1.2	5.37
		1.5	4.66

Fig. 1 — Pressure-velocity chart reflects current trends in design practice

product of pressure and velocity, *Fig.* 1 was drawn, upon which this relation may be shown together with others that appear more useful from the point of view of recent analytical studies. The base line of this chart carries a scale for the bearing pressure P in pounds per

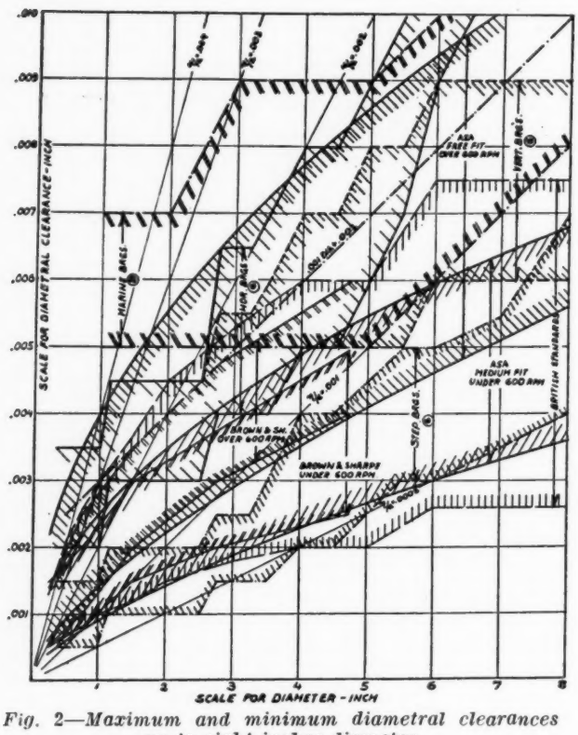


Fig. 2—Maximum and minimum diametral clearances up to eight inches diameter

square inch. In the case of journal bearings this pressure is determined by dividing the total bearing load R by the projected area of the journal which is its diameter times its length, DL. The vertical scale of this chart is for the relative velocity V of the bearing surfaces in feet per minute. The two scales were laid off on double-logarithmic paper.

Values May Be Estimated

From upper left to lower right parallel lines are drawn, each of which represents the product $P \times V$, ranging from 2,500,000 down to 5000. By referring to these lines the value of $P \times V$ may be estimated for any point on the chart.

For the study of the tabulated data, from the viewpoint of Dr. Kingsbury's "Optimum Conditions in Journal Bearings,"[1] the chart contains three diagonal-scale panels in the upper right corner. These are drawn for 120-degree bearings only.

One of these scale panels covers "centrally loaded clearance bearings" having L/D ratios of 0.8, 1.0, 1.2, and 1.5. Crossing the diagonal lines extending from these ratios, are short horizontal lines whose positions relative to the L/D lines represent values of the group $[(\mu/a) \times (a/\eta)^2]$ as indicated. (μ = absolute viscosity in the bearing film, lb.-sec. per sq. in., Reyn.; a = radius of journal, inches; η = radial clearance between journal and bearing, inches).

Another of these diagonal-scale panels gives the optimum characteristics of the "eccentrically loaded clearance bearing."

A similar scale panel is given for the "fitted bearing." In this case the clearance ratio cannot appear and the symbol group used for interpreting data would be $[(\mu/a) \times (a/h_o)^2]$. ($h_o$ = minimum film thickness).

Side Leakage Considered

For all of these diagonal-scale panels the influence of side leakage has been taken into account.

These panels, with their L/D values and the values of the other symbol groups, furnish ready means for obtaining the relation between the oil viscosity, the journal radius, the clearance ratio in clearance bearings, and the minimum film thickness, that will produce the optimum condition.

In order to group the data by headings that would quickly call attention to their positions on

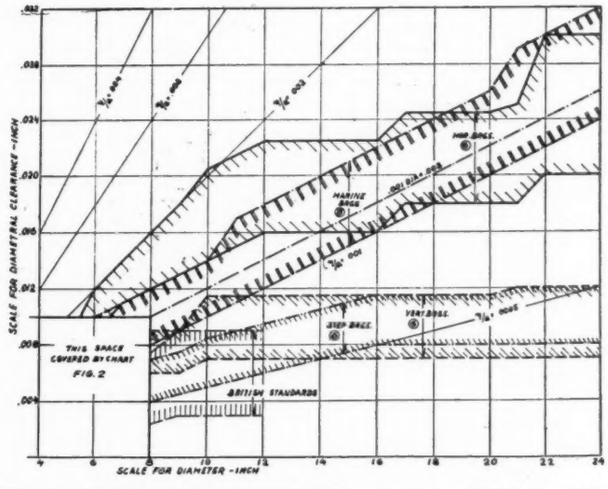


Fig. 3—Clearances above eight inches diameter indicate wide divergence of practice

the chart, heavy lines were drawn around them. It will be noted that in many cases these heavy outlines are vertical and diagonal from upper left to lower right. In other cases the data groups are surrounded by heavy lines that are horizontal and vertical.

In the case of data on Kingsbury journal and thrust bearings it is seen that lines defining them run in general from upper right to lower left, and that the meaning of the data is further de-

[1] *A.S.M.E. Trans.*, 1932, paper RP-54-7-123.

fined by references to viscosities and to revolutions per minute.

Fig. 1, with its pressure and velocity co-ordinates, should be of assistance to designers in the improvement and standardization of practice. While it affords the user of the *PV* rule means for choosing a clearance ratio and viscosity that will rationalize his design, it also shows that the *PV* rule by itself has little to recommend it. Careful consideration of the $[(\mu/a) \times (a/\eta)^2]$ group will be of value to the designer.

A study of bearing clearances indicates a wide divergence of practice that will be evident from an examination of clearance charts. In most cases journal-bearing clearance data are given with upper and lower limits.

Bearing Clearance Given

In *Figs.* 2 and 3 the total clearance and bearing diameters are given. In order that the other data may be interpreted with reference to the clearance ratio, η/a reference lines are drawn for these with values varying from 0.0005 to 0.004.

The upper and lower limits are shown in all cases. The range of *Fig.* 2 includes a total clearance of 0.010 and diameters up to 8 inches. *Fig.* 3 extends this range to larger clearances and greater diameters. The dot-and-dash lines marked "0.001 diam + 0.002" shows a rule used by Kingsbury for ordinary journal bearings.

If clearances are to be chosen from these charts they must for best results be supplemented by the use of a suitable oil.

May Determine Optimum Value

Upon the pressure velocity chart, *Fig.* 1, there have been marked the values of the eccentricity found to be productive of the optimum condition of operation. It is obvious that by means of this value, for the centrally loaded bearing, the minimum film thickness h_o may be determined. It must be remembered, however, that Dr. Kingsbury pointed out in his studies that the optimum conditions described by him can exist for any minimum film thickness that may be selected as safe. Hence, if it is felt that the found h_o value is too great it may be reduced and optimum conditions preserved if the clearance ratio is also reduced.

The question arises as to what may be considered a safe value for h_o. This question would lead to a very extensive study of data furnished by various manufacturers, which is beyond the scope of this paper. However, the following suggestion may be found useful in this connection.

An examination of the loading tables published furnishes a means for determining minimum film thicknesses for Kingsbury thrust bearings. It may be assumed that journal bearings would operate equally safely, under similar conditions as to purity of oil, with similar minimum film thicknesses. Hence *Fig.* 4 is offered, giving loads and estimated minimum film thicknesses for Kingsbury thrust bearings for various sizes and speeds. Load correction factors are given for other than tabulated load values. Viscosity coefficient $= 3.4 \times 10^{-6}$ Reyns.

Oil Selection Difficult

The problem of selecting oils suitable for various classes of machinery is difficult because of the present habit of depending for their selection only upon commercial viscosities such as Saybolt, Redwood, and Engler. An extensive study has

FACE AREA (SQ. IN.)	SURFACE SPEED, FEET PER SECOND = V								
	5	10	20	40	60	80	100	120	140
	CAPACITY, POUNDS PER SQUARE FACE								
4	855 .00036	1015 .00047	1210 .00061	1440 .00079	1590 .00092	1710 .00102	1810 .0011 2	1890 .00119	1960 .00126
16	4060 .00047	4830 .00061	5750 .00079	6850 .00103	7550 .00119	8150 .00132	8600 .00145	9000 .00155	9350 .00163
36	10,100 .00055	12,000 .00071	14,300 .00092	17,000 .00119	18,750 .00138	20,200 .00154	21,400 .00168	22,400 .00180	23,200 .00192
64	19,300 .00061	23,000 .00079	27,400 .00102	32,500 .00133	36,000 .00155	38,600 .00172	40,900 .00188	42,800 .0020	44,500 .00215
100	31,900 .00066	38,000 .00086	45,200 .00112	53,500 .00145	59,500 .00168	64,000 .00186	67,500 .00205	70,700 .0022	73,500 .00235
144	48,000 .00071	57,200 .00092	68,000 .00119	81,000 .00155	89,500 .00180	96,500 .0020	102,000 .0022	106,500 .00235	111,000 .0025
196	68,000 .00075	81,000 .00098	96,000 .00127	114,500 .00163	126,500 .00190	136,000 .0021	144,000 .0023	150,000 .0025	156,000 .00265
256	92,000 .00079	109,000 .00103	130,000 .00133	155,000 .00172	171,000 .0020	184,000 .0022	194,000 .00245	203,000 .0026	211,000 .0028
324	119,000 .00083	142,000 .00108	168,000 .00138	201,000 .00180	222,000 .0021	239,000 .0023	252,000 .00255	264,000 .0027	274,000 .0029
400	152,000 .00086	181,000 .00112	215,000 .00145	256,000 .00188	283,000 .0022	304,000 .0024	321,000 .00265	336,000 .0028	350,000 .0030

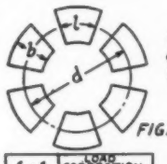


FIG.-T.

FOR AVERAGE PROPORTIONS OF THRUST BEARINGS, d = 3l.
FOR ANY RATIO OF b TO d, IF l = b THE BEARING AREA WILL TOTAL 6 × l^2 FOR SIX SHOES, AND THE TOTAL CAPACITY WILL BE THAT IN THE TABLE TIMES THE NUMBER OF SHOES.
TO FIND THE FEET PER SECOND FROM THE R.P.M.
$\frac{V}{60} = \frac{\pi d N}{12 \times 60}$

l ÷ b	LOAD CORRECTION FACTOR
0.50	1.557
0.67	1.357
1.00	1.000
1.33	0.732
1.50	0.630
2.00	0.423

TABLE IS BASED ON ASSUMPTION THAT l = b.
FOR OTHER PROPORTIONS MULTIPLY THE TABULAR LOAD BY THE CORRECTION FACTOR IN TABLE AT LEFT.

* TABLE IS BASED ON DATA GIVEN IN BULLETINS ON KINGSBURY BEARINGS PUBLISHED BY KINGSBURY MACHINE WORKS, INC., PHILA., PA. THE UPPER VALUE IS THE CAPACITY AND THE LOWER ONE IS THE MINIMUM FILM THICKNESS-h_o.

Fig. 4—Thrust bearing capacity table gives film thicknesses for freely pivoted shoes

led the author to the conclusion that for pure mineral oils of the various bases now used, it should matter little whether oils are classified by *commercial viscosity,* such as measured in Saybolt seconds, or by *absolute viscosity,* as measured in Poises or other units. For the solving of bearing problems, however, the absolute viscosity must be known for use in exact physical formulas.

Whatever the system of oil classification used, it is essential that the oil be described as having a definite viscosity at a temperature near that at which the oil will be used. It seems unnecessary and it is unwise to continue to describe oils only by viscosities at temperatures such as 100 F and 210 F, because, after all is said, a certain calculable viscosity is the property that it is desired to attain at some definite operating temperature.

Trademarked Machines Increase Confidence of Purchasers

By George V. Woodling

A TRADEMARK is the commercial signature applied to one's goods. In many cases a good trademark is more valuable than a good patent. This is particularly true where the trademark has acquired nation-wide use and great public acceptance and popular favor. A trademark is indispensable in advertising campaigns and sales promotion work.

The paramount object of a trademark is to indicate the *origin* or *ownership* of the goods to which it is attached, and not to name or describe the quality of the goods. In this manner, a trademark functions to protect the honest trader from those who would take advantage of his reputation. It has been held that a trademark is not an article of merchandise, nor is it an article of commerce. It is not bought, sold, or consumed.

PROMINENT among the many phases of the protection of machines and parts against competition is the question of trademarks, covered herein, this being an important division in the field of patents. The next article in this series will cover patent departments and their organization.

A trademark cannot be assigned by itself. It is not a property in gross. It can be assigned only in connection with the goodwill of the business with which the mark is used. A typical assignment is shown in *Fig.* 6.

The ownership of a trademark is a common-law property right. It does not derive its existence from any trademark statutes. In other words; a trademark is protected even in the absence of a statute. However, the common-law remedy or redress against trademark piracy is often unsatisfactory and expensive. Therefore, Congress has passed certain legislation tending to aid the common-law remedies for affording more direct and effective redress against unlawful use.

The legislation is a mere regulation of a pre-existing right founded in common law. Therefore, the property right in trademarks is not created by the Federal Trademark Law. Average owners of trademarks are unaware of this fact. They consider the registration of their trademark (good for twenty years and renewable) as a special grant by the United States Government. Actually, the registration of a trademark is nothing more than the *recording* of the trademark with the government.

In view of the fact that the property right of trademarks is not created by the Federal Trademark Laws, the question of *territorial extent* of trademarks is in a most unsatisfactory condition. Thus, the Supreme Court has held that when two companies doing business in different localities adapt similar trademarks they each have the legal right to continue to use their own marks, even though they subsequently expand their trade to cover the same territory.

The question of prior appropriation is legally insignificant where two parties independently employ the same mark on goods of the same class when the operations are in separate markets wholly remote from each other, unless it appears that the second adopter has selected the mark with some purpose inimical to the interests of the first user, such as to take the benefit of the reputation of and to forestall the extension of the trade of the first user. The fact that one of the users may have his mark registered in the Patent Office makes no difference, because it has been held by the Supreme Court that the adoption of a trademark does not

Copyright, 1935, by George V. Woodling

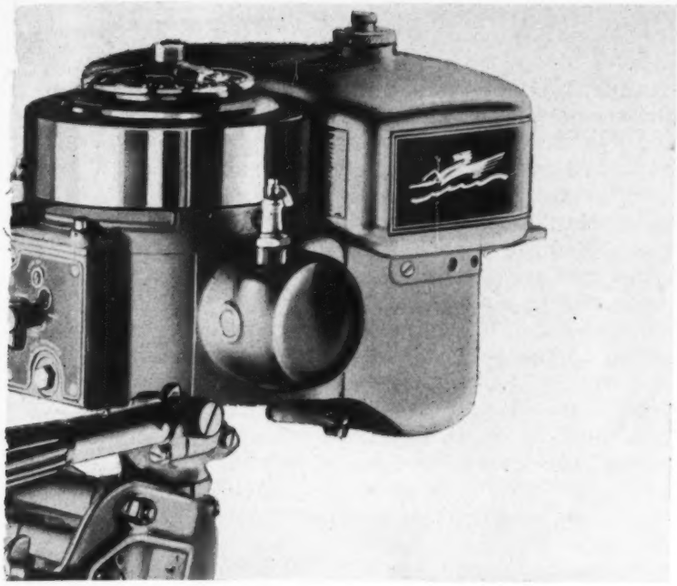


Fig. 1—Distinctive mark used on outboard motors is symbolic of the name of the motors, the Sea Horse

project the right of protection in advance of the extension of the trade, or operate as a claim of territorial rights over areas into which it may thereafter be determined desirable to extend the trade. However, by the rapid growth of national advertising throughout the last few years there is a general belief that the former decisions of the Supreme Court may eventually be modified.

In view of the uncertainty of the trademark laws, there is a tendency to decide trademark cases upon the grounds of unfair competition. This induces the decision to turn upon the broad principle of whether or not the alleged wrong doer passed off his goods as the goods of the complainant, regardless of the existence of any technical trademark. To this end, it has been said that the trademark law is being gradually merged into that of unfair trade, except where the question of jurisdiction is to be determined. The question is not so much whether there is a valid trademark, but whether the complainant has built up a valuable business under some word, sign, or symbol. The paramount distinction between cases of infringement of a trademark and cases of unfair competition, is that in trademark cases it is not necessary to prove fraudulent intent as it is in cases of unfair competition. Nor is it necessary in trademark cases to prove that the trademark has acquired popular favor or great public acceptance as is required in cases of unfair competition in which it is the real basis for redress.

Fig. 2—Use of a good trademark on a prominent part of the machine enhances the value of the mark as a sales stimulant

Even though a registered trademark does not project the territorial rights of the mark in advance of the trade, yet the registration of a trademark in the Patent Office has the following advantages over and above the common-law remedies. In the first place, let us assume that a dispute arises between two persons claiming the same trademark and that one of the parties has a registered trademark and the other party has not. In determining who is entitled to the trademark, all other things being equal, the question is, who was the *first* user. In proving this, each party introduces evidence to show when he first adopted and used the trademark.

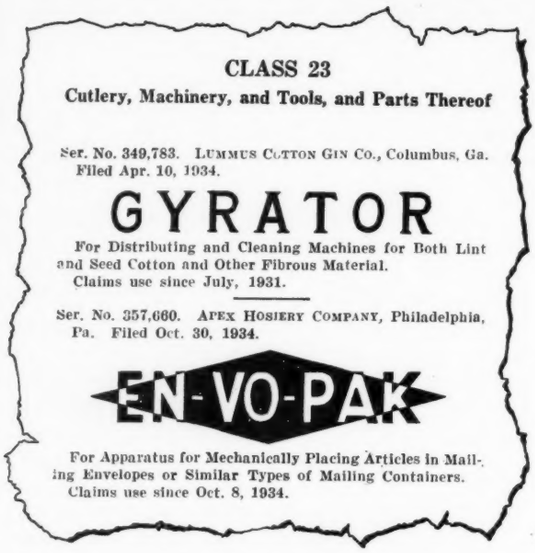
In this dispute, the party who has the registered trademark may establish the date of his use by introducing his certificate of registration in the record. This is all that he is required to do, because the registration of the trademark is prima facie evidence of use and ownership. The other party then has the burden of proof of showing that he adopted the trademark before

KLEENWAY
FLUID DRAINER AND PUMP
PATENTS PENDING
KLEEN-WAY PRODUCTS COMPANY
CLEVELAND, OHIO, U. S. A.

Fig. 3—Five specimens or facsimiles of the trademark such as this one must be submitted with registration

his opponent filed the trademark registration. Ordinarily, this is quite difficult to do, because of carelessness in keeping private records.

All registered trademarks are placed on file in the Patent Office for public inspection, thus enabling a possible competitor to make a search of the records of the trademarks and thereby avoid the adoption of a trademark which has been used and registered. To this end, the recording of a trademark in the Patent Office acts as a clearing house to avoid possible difficulty with similar trademarks. Furthermore, the registration of a trademark entitles the owner to mark his product with the notice: "Reg. U. S. Pat. Off." This constitutes legal notice to the public that the owner has registered the mark and claims its rightful ownership. It is important that all such registered marks carry the legal notice, for the reason that the trademark laws



CLASS 23

Cutlery, Machinery, and Tools, and Parts Thereof

Ser. No. 349,783. LUMMUS COTTON GIN CO., Columbus, Ga. Filed Apr. 10, 1934.

GYRATOR

For Distributing and Cleaning Machines for Both Lint and Seed Cotton and Other Fibrous Material. Claims use since July, 1931.

Ser. No. 357,660. APEX HOSIERY COMPANY, Philadelphia, Pa. Filed Oct. 30, 1934.

EN-VO-PAK

For Apparatus for Mechanically Placing Articles in Mailing Envelopes or Similar Types of Mailing Containers. Claims use since Oct. 8, 1934.

Fig. 4—Classification and use of trademarks are included with their publication

provide that it is the duty of the registrant to give notice to the public that the trademark is registered. Failure to mark goods prevents the recovery of damages for past infringement, except on proof that the defendant was duly notified of infringement and continued the same after such notice.

Three Requisites Listed

In order to register a trademark in the Patent Office it must have three main requisites:

INTERSTATE COMMERCE USE. The trademark must be used in lawful commerce among the several states. This is because the apparent validity of the trademark laws are based upon the right of Congress to regulate the commerce among the several states. In other words, if the trademark is used locally within a certain state, the jurisdiction of the Patent Office is not invoked. It has been held that a single shipment of goods in interstate commerce is sufficient, but it is highly important that the shipment or sale in another state shall be bona fide, and not merely a subterfuge to comply with the law.

TRADE MARK AFFIXED TO GOODS. The trademark must be in some way applied or affixed to the goods in lawful commerce. This may be done by printing, impressing, embossing, molding, casting, or otherwise applying the mark directly upon the goods, or it may be affixed to the goods by means of a label or tag upon which the trademark is shown. It has been held that to display the mark on a show card accompanying the goods in a show window or the like is not sufficient to establish a trademark. Also, the use of a trademark in advertising material does not meet the requirements of the trademark laws.

In applying for a registered trademark the applicant must include five specimens or facsimiles of the trademark as actually used upon the goods, see *Fig.* 3. In the event that the trademark is molded or cast upon the goods, the applicant may send five photographs of the mark. Also, the drawing of the trademark which accompanies the registered papers should conform exactly to the manner that the trademark is displayed upon the goods.

DISTINCTIVENESS. There are two trademark acts relating to the registration of trademarks. One is the Act of 1905 amended, and the other the Act of 1920. Under the Act of 1905, the trademark must be distinctive, and not *descriptive, geographical,* or *a proper name.* Under the Act of 1920 the trademark need not be distinctive. It may be *descriptive, geographical,* or *a proper name.*

Registration under the Act of 1920 does not give the owner prima facie evidence of ownership, as does the law of 1905. Also, before registration can be made under the 1920 Act, the mark must have been used in interstate commerce for a period of not less than one year. The election whether or not the applicant should file under the 1905 Act or the 1920 Act is not merely arbitrary, but must be decided upon the nature of the mark. If the mark is distinctive, and not descriptive, geographical, or a proper name, then the application must be made under the Act of 1905. On the contrary, if the mark is descriptive, geographical, or a proper name, the registration must be filed under the Act of 1920. However, sometimes the nature of the mark leaves doubt as to which Act it should be registered under, and in these cases it is always a good policy to file first the registration under the Act of 1905, because this gives prima facie evidence of ownership, and then if the Patent Office decides it is descriptive or geographical, or a proper name, then registration may be changed to the 1920 Act.

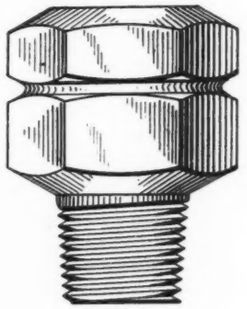


Fig. 5—An interesting type of registration is the listing of the groove on this valve as a mark distinctive to its manufacturer

Except for the qualifications given in the foregoing, the trademark may comprise any distinctive mark, or symbol, and may consist of a word, phrase, signature, photograph, monogram, or sign that a manufacturer places upon his goods to distinguish them from the goods of others. While the trademark may not be *descriptive* of the goods to which it applies, it may, however,

be *suggestive*. For example, the title "Bore-Matic" is a suggestive word. So is the word "Kleenway" suggestive, see *Fig.* 3.

No word or combination of words can be exclusively appropriated as a trademark if it is merely geographical or descriptive of the quality, style, character, grade, or the class of goods. The true test in determining whether a particular name or phrase is geographical or descriptive is whether in its common use, the word reasonably indicates the geographical sense or describes the goods. It is the impression which the word ordinarily conveys to the public. Take the word "Portage" for illustration. The main thought conveyed by the word "Portage" is the act of transporting, especially by canoe from one navigable water to another. At the same time, the word "Portage" is a geographical name of a few small towns. Yet the Patent Office has indicated that the geographical sense of the word is substantially of no consequence as compared to the thought conveyed of transportation from one navigable water to another, unless the manufacturing concern or owner resides in one of the towns. Therefore, the word "Portage" may be registered in the Patent Office as a distinctive or fanciful mark. A word may be descriptive for one class of goods and nondescriptive for another class of goods.

A trademark must not be misdescriptive, because this would tend to deceive the public. The word "metallized" has been held to be misdescriptive of radio resistors, since there is no metallization of any character in the resistor. Color alone cannot be used as a trademark.

In order to register the name of an individual, firm, corporation, or association under the 1905 law, it is necessary that the mark be printed or displayed in some particular or descriptive manner. Hence, a person's signature is registerable as a trademark because of the descriptive manner in which it is written, see *Fig.* 7. In the case of a photograph of a living person, it is necessary that the consent of the person be obtained before the mark can be registered. Nor can the portrait of any deceased President of the United States be registered during the life of his widow, except by the consent of the widow. Also, registration cannot be obtained on immoral or scandalous matter, nor any mark simulating the flag or coat of arms or other insignia of the United States.

ASSIGNMENT OF REGISTERED MARK

Whereas XYZ Corp. *of the city of* Cleveland *county of* Cuyahoga, *and State of* Ohio, *has adopted and used in his business a trade-mark, which is registered under No.* X3474, *dated* May 14 1932, *in the United States Patent Office; and*

Whereas MNO Corp. *of the city of* Cincinnati, *county of* Hamilton, *and State of* Ohio, *is desirous of acquiring said mark:*

Now, therefore, to all whom it may concern:

Be it known that for and in consideration of the sum of One *dollars and other good and valuable consideration to him in hand paid, the receipt of which is hereby acknowledged, said* XYZ Corp. *by these presents does sell, assign, and transfer, unto the said* MNO Corp. *the entire right, title, and interest in and to the said trade-mark and the registration thereof, No.* X3474, *together with the good will of the business in connection with which the said mark is used.*

XYZ Corp.

State of Ohio
County of Cuyahoga } ss:

Personally appeared before me the said XYZ Corp. *and acknowledged the above instrument as his free act and deed this* 24th *day of* Feb., 1935.

Richard Roe
Notary Public.

Fig. 6—Trademarks can be assigned only in connection with the goodwill of the business

CLASS 3

Baggage, Animal Equipments, Portfolios, and Pocketbooks

Ser. No. 357,727. AMELIA EARHART, INC., New York, N. Y. Filed Oct. 31, 1934.

Amelia Earhart

The signature is a facsimile of that of Amelia Earhart, president of the applicant corporation.

For Hand Luggage of All Types—Namely, Suitcases, Hat Boxes, Hand Trunks, Wardrobe Cases, Hand Bags, and Trunks.

Claims use since Apr. 26, 1934.

Fig. 7—Because of their distinctive character, signatures can be registered

Must Be Distinctive

Moreover, a trademark cannot be registered if it resembles an existing registered trademark for a similar article. The following list of words will give a general idea of the similarity or nonsimilarity of words: Ground Gainer held like Ground Gripper, Dazzie held like Dazzle, Siz-L-Hot held like Sizzling, Mixer King held like Mix Master, Takeall held not like Fitall, Vapex held not like Vaporub, since "Vap" had long been used by others.

The Patent Office has divided merchandise into fifty classes and the same trademark may be registered in different classes. The Courts and the Patent Office have divided each of the classes into a number of subclasses, being based primarily upon the trade. Accordingly, the word

(*Concluded on Page* 69)

Rubber Proves Effective Material for Machine Mountings

By Harold F. Shepherd

RUBBER mountings, like other machine elements, are designed to carry certain safe loads as specified by the manufacturer of the material. Unit types similar to *Fig.* 1, and shapes similar to *Fig.* 2, are widely used for general machinery since they may be adapted without excessive design and development costs.

Adaption is simple. The mid-points of support being chosen, the machine is weighed in the less complex cases while resting on knife edges or rollers placed as in *Fig.* 4. If the machine weighs 2000 pounds and the scale records W_1 as 500 pounds, and W_2 as 1500 pounds for designs symmetrical on the transverse plane, proportionate lengths of the formed material may be placed symmetrically about each point of support.

Thus, if the mounting is capable of supporting 50 pounds per inch of length, 40 inches of material will be required, or twenty inches on each side. Each twenty-inch length will be subdivided into two parts.

$(500/2000) \times 20 = 5$ inches long for supporting $(1/2)W_1$
and $(1500/2000) \times 20 = 15$ inches long for supporting $(1/2)W_2$

Or if units like *Fig.* 1, presented by J. Ormondroyd in his article on mountings (MD, Dec. 1931), are available with a rating of 250 pounds each, one might be placed on each side at W_1, and three on each side at W_2. If even larger units, of say 750 pounds rating, are obtainable, these larger units might be placed at W_2, one on each side, and the smaller units of 250 pounds rating used at W_1, provided they deflect equal amounts, a matter to be considered later under the heading, "Natural Frequency."

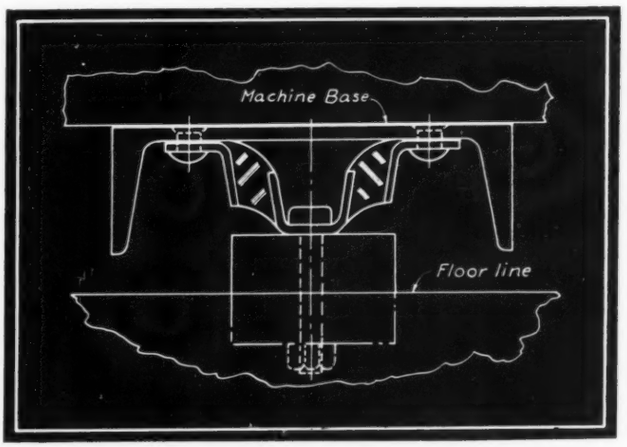


Fig. 2—Formed mountings may be adapted without excessive design or development costs

The overhanging gearcase of an engine in *Fig.* 4 may be considered objectionable. If it weighs 200 pounds and its moment about W_2, when supported by lugs W_3, at the distance x is 100 x foot pounds, it may be desirable to carry 100 pounds at the two lugs. This will tip the engine about W_2 as a fulcrum, redistributing the weight. The job then may be weighed by using an additional balance or crane scale adjusted to lift 100 pounds at W_3, as shown by the dotted lines in *Fig.* 4, or the redistribution of weight may be calculated from the two-point

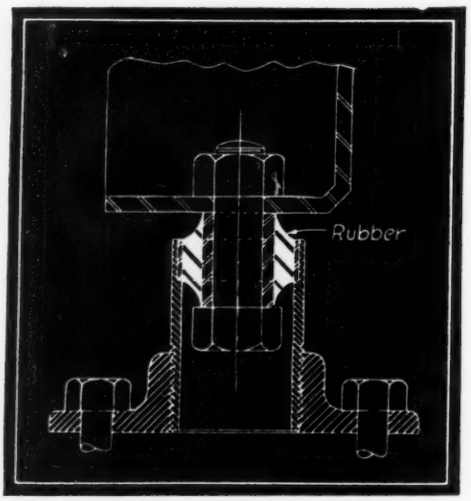


Fig. 1—Unit type of rubber mountings are widely used for machinery

weighing by the method of moments.

Let $x=1, y=2$

Added load at $W_1 = \frac{1}{2} \times 100 = 50$ pounds

Relief of load at $W_2 = (3/2) \times 100 = 150$ pounds

Then

$W_1 = 500 + 50 =$	.....	550 pounds
$W_2 = 1500 - 150 =$	.....	1350 pounds
$W_3 =$	.....	100 pounds
	TOTAL REMAINS	2000 pounds

In this case the strip stock will be cut as

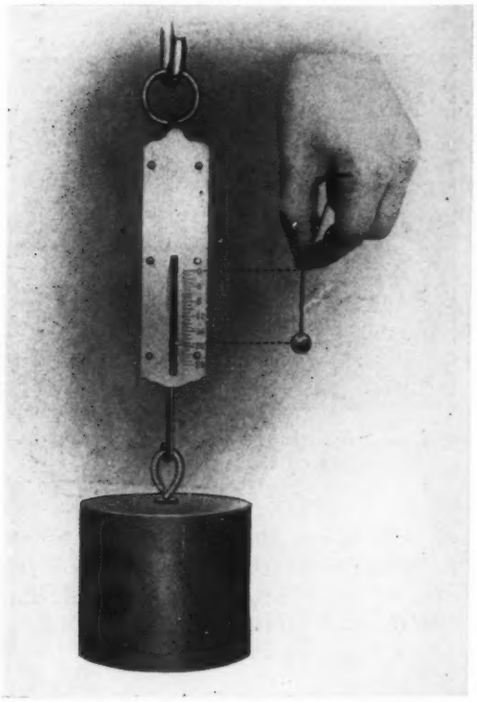


Fig. 3—Axiomatic principle is illustrated by simple device

shown in the following:

W_1	(550/2000) × 20 =	5.5 inches long
W_2	(1350/2000) × 20 =	13.5 inches long
W_3	(100/2000) × 20 =	1 inch long

Total length per side—20.0 inches as before

If the machine is not symmetrical on the transverse plane, the more elaborate procedure required for weighing will be suggested by the foregoing examples.

Rubber Will Be Stressed Equally

With any of these proposed mountings the rubber will be stressed equally at any point of support. Mounting deflections will be equal, and consequently unexpected machine strains will not be produced. Also, the machine will set level with very slight adjustment on a level foundation.

Fig. 3 illustrates an axiomatic principle, the mathematical proof of which can be found in various standard works. A weight supported by a spring will oscillate freely once it is set in

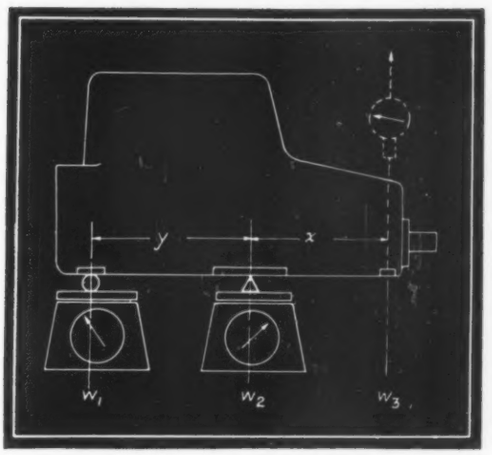


Fig. 4—Machines may be weighed while resting on knife edges or rollers

motion at the same rate as a pendulum having a length equal to the static deflection of the spring. Thus, in the formula for the period of the pendulum,

$t = 2\pi\sqrt{l/g}$

t = time in seconds

l = inches length of pendulum = inch deflection of spring

g = acceleration due to gravity = 386 inches per second squared

If a spring mounting deflects ⅛-inch under its dead loading the natural period of oscillation of the load will be

$t = 6.2832\sqrt{(0.125/386)} = 0.113$ seconds

The frequency of oscillation will be

$1/t = 1/0.113 = 8.85$ vibration per second = 531 vibrations per minute

Of course, rubber mountings may not deflect proportionately to the load, in which case the length of pendulum becomes equal to the rate of deflection about the equilibrium point times the dead loading rather than the actual deflection. However, modern mountings using rubber in combined shear and compression exhibit surprisingly straight deflection curves in their working range as shown by *Fig.* 5. Usually the simpler calculation is accurate enough to insure the desired results.

Determining Disturbing Force Frequency

Knowing how to determine the natural frequency of the system in vertical oscillation, it is essential to know next how this should be related to the disturbing force frequency.

Here again mathematicians have developed certain useful facts. It has been demonstrated that the transmission factor, i.e., the ratio between the force transmitted to the foundation and the disturbing force equals

$$\epsilon = \frac{1}{1 - (\omega^2/\omega_c^2)}$$

in which ω equals the disturbing frequency and

ω_e equals the natural frequency.

Thus when the ratio

$$\omega/\omega_c = 1$$

$$\epsilon = \frac{1}{1-1^2} = \frac{1}{0} = \text{infinity}$$

if there is no damping. This implies resonance and the building up of disrupting amplitudes.

When

$$\omega/\omega_c = 1.4$$

$$\epsilon = \frac{1}{1-1.4^2} = \frac{1}{1} = 1$$

Again there being no damping, at this ratio spring mountings are of no use. The advantage grows rapidly as the ratio ω/ω_c increases.

When the ratio is 2

$$\epsilon = \frac{1}{1-(\omega^2/\omega_c^2)} = \frac{1}{1-4} = \frac{1}{3}$$

When the ratio is 3

$$\epsilon = \frac{1}{1-(\omega^2/\omega_c^2)} = \frac{1}{1-9} = \frac{1}{8}$$

This latter is a very practical value for many

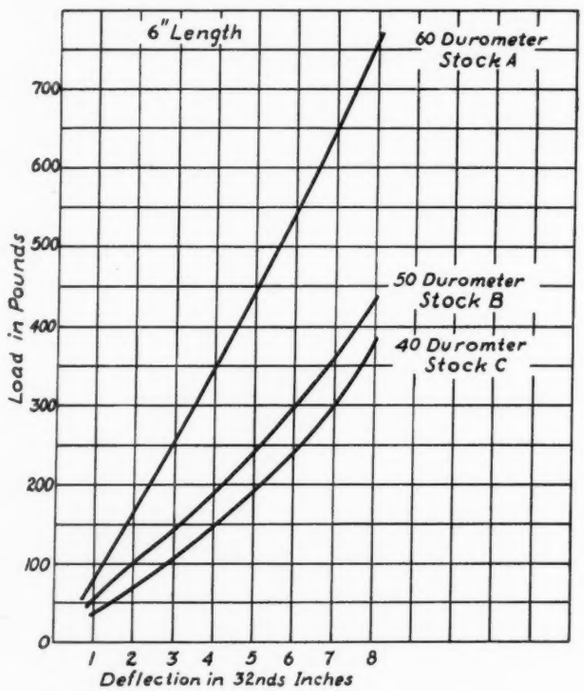


Fig. 5—Deflection curves of modern mountings using rubber are surprisingly straight

jobs. Thus, in the case of a rubber mounting showing a static deflection of one-eighth inch and a natural frequency of system equal to 531 vibrations per minute as in the foregoing example, 1/3 of the free force of unbalance is transmitted at $2 \times 531 = 1062$ R. P. M. and only ⅛ at $3 \times 531 = 1593$ R. P. M. This indicates that a mounting showing one-eighth inch static deflection is very effective for eliminating vertical rotating unbalanced disturbances at 1500 or more R. P. M. and fairly effective at about 1000 R. P. M.

Fortunately the frequency of torque reaction cycles in both alternating current machinery and internal combustion engines usually is higher than the speed of rotation, often much higher. Therefore, a mounting designed for a low ratio of force transmission at the rotation speed usually is successful in eliminating the transmission of vibration due to other causes.

When the mounting is below the horizontal

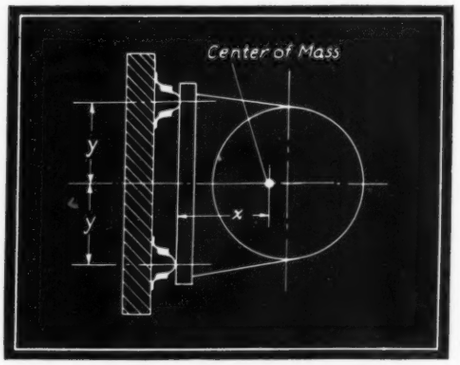


Fig. 6—Rocking effect can be estimated by imagining machine set on side

plane of this main shaft of machines such as motors, rotation unbalance produces rocking as well as vertical oscillation. The effect of this is estimated most simply by imagining the machine set on edge as in *Fig.* 6.

Can Determine Rocking Frequency

If $x = y$, the spring or rubber deflections are apparently equal to those due to the dead weight in the vertical position, although in this case the forces acting in the two springs are opposte in direction. From this arrangement it can be determined that the natural rocking frequency will equal that of vertical oscillation. As y is diminished the frequency becomes higher, an undesirable condition, so the usual high sub-base often may serve satisfactorily with the rubber units placed under the bottom flange.

As x and y rarely are exactly equal, two critical speeds often are noted in starting the apparatus. One is due to vertical oscillations and the other to rocking moments. Both disappear at operating speeds.

As few machines are symmetrical along the vertical longitudinal mid-section, the center of mass is difficult to locate and some experimental work may be required. However, a surprising number of cases respond to the simple treatment described in the foregoing in which only vertical forces of the frequency of shaft rotation are considered, as it is known that most other free forces are of higher frequencies.

New Machines Indicate Design Trends

THE DAY when there was but one logical material for a designer to use for the part under development is past. Research and development have so advanced the position of the great group of materials available that now the design profession must weigh one material against another to select the one most advantageous for his part.

Among the most prominent changes is the increased number of materials available for die castings. Designers are applying zinc, aluminum, aluminum bronze, brass and magnesium die castings in their machines. Composition materials form another group receiving considerable attention. A listing of available plastics begins on page 34 of the February MACHINE DESIGN.

Machines recently announced in addition to those on the next two pages include the following, arranged by fields of application:

Ceramic

Batch Mixer,
C. O. Bartlett & Snow Co.,
Cleveland.

Chemical

Pump,
Dearborn Chemical Co.,
Chicago.

Construction

Vibrating Screen,
Robins Conveying Belt Co.,
New York.
Three-Tine Rock Grappler,
Blaw-Knox Co.,
Pittsburgh.
Electric Metal Scaling Hammer,
Syntron Co.,
Pittsburgh.

Domestic

Ironer,
Westinghouse Electric & Mfg. Co.,
East Pittsburgh, Pa.
Dishwasher,
General Electric Co.,
Cleveland.
Washing Machine,
Barlow & Seeling Mfg. Co.,
Ripon, Wis.
Electric Refrigerator,
Atwater Kent Mfg. Co.,
Philadelphia.
Vacuum Sweeper,
Clements Mfg. Co.,
Chicago.
Washing Machine,
Westinghouse Electric & Mfg. Co..
East Pittsburgh, Pa.

Food

Preheater,
Patterson Foundry & Machine Co.,
East Liverpool, O.
Bread Slicing and Wrapping Machine,
National Bread Wrapping Machine Co.,
Boston.

Foundry

Jolt Squeeze Stripper Type Molding Machine,
Osborn Mfg. Co.,
Cleveland.
Gyratory Riddle,
Newman Bros. Inc.,
Cincinnati.

Gasoline

Volatile Liquid Pumps,
Roots-Connersville Blower Corp.,
Connersville, Ind.

Industrial

Multiple Stroke Lift Truck,
Barrett-Cravens Co.,
Chicago.
Testing Machine,
Baldwin-Southwark Corp.,
Philadelphia.

Metalworking

Stationary Keyway Cutter,
Morton Mfg. Co.,
Muskegon Heights, Mich.
Safety Type Grinders and Buffers,
Production Equipment Co.,
Cleveland.
Knife Grinder,
Samuel C. Rogers & Co.,
Buffalo.
Two Post General Purpose Presses,
Waterbury Farrel Foundry & Machine Co.,
Waterbury, Conn.
Die Casting Machine,
Newton-New Haven Co.,
New Haven, Conn.
Hydraulic Internal Grinders,
Landis Tool Co.,
Waynesboro, Pa.
Single Geared, Double Crank Press,
Henry & Wright Mfg. Co.,
Hartford, Conn.

Metallurgy

Vacuum Filter,
Booth-Thompson Division,
Galigher Co.,
Salt Lake City, Utah.

Power Boating

Marine Diesel,
Kermath Mfg. Co.,
Detroit.

Rubber

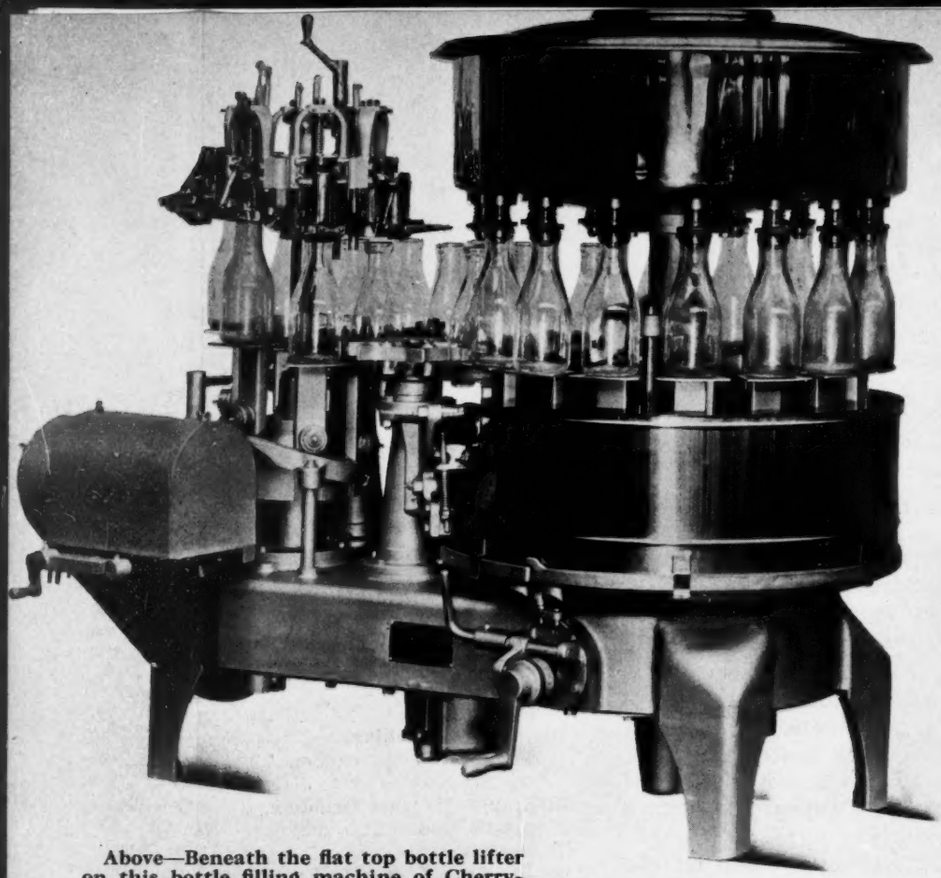
Shear,
Baldwin-Southwark Corp.,
Philadelphia.

Textile

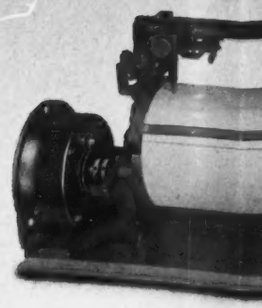
Drier,
Philadelphia Drying Machinery Co.,
Philadelphia.
Industrial Sewing Machine,
Union Special Machine Co.,
Chicago.
Cutting and Winding Machine,
Fabric Machine Co. Inc.,
Bridgeport, Conn.
Cutting and Winding Machine,
Consolidated Sewing Machine & Supply Co. Inc.,
New York.

Woodworking

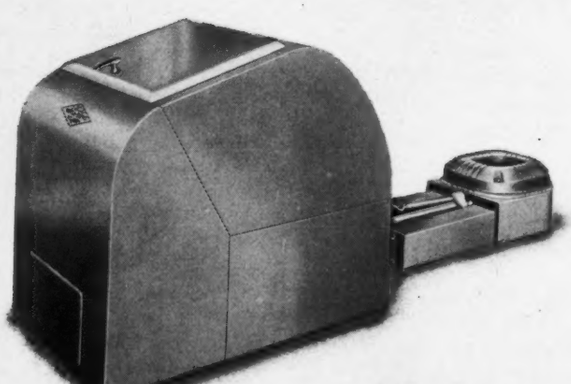
Portable Saw,
Porter-Cable Machine Co.,
Syracuse, N. Y.



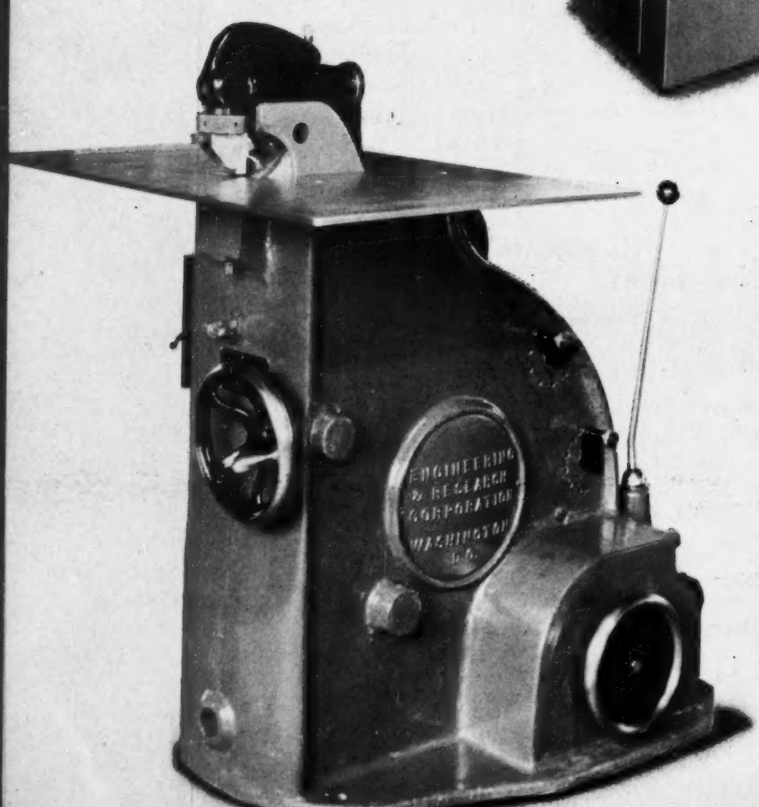
Above—Beneath the flat top bottle lifter on this bottle filling machine of Cherry-Burrell Corp. is a hardened roller which projects outwardly to contact a lifter cam. The roller, following the cam, raises lifter and bottle to the valve. As the roller leaves the cam, a roller clutch, in the guide, locks the lifter in place. At completion of filling, a trip releases the lifter and it is carried down again. The base of the machine is a one-piece gray iron casting, cadmium-plated and finished in aluminum bronze. There are six revolving parts, all driven by a heavy-duty roller chain which passes around an idler sprocket to keep the chain tight.



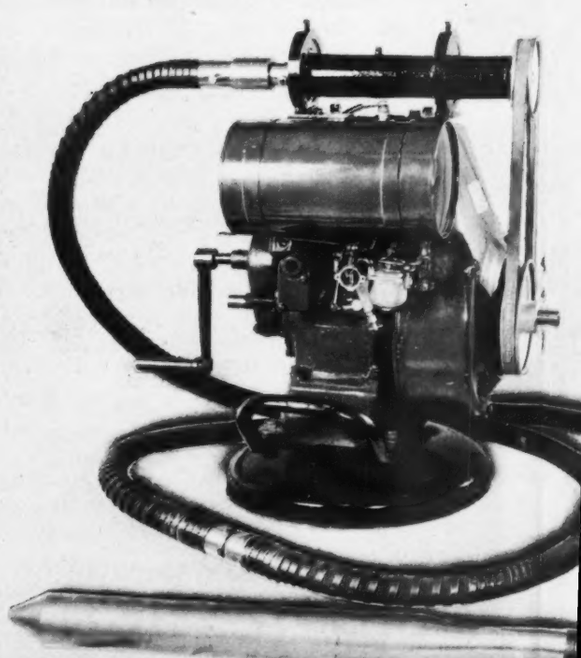
Right — Baldwin-Southwark Corp. stress-strain recorder uses an accurate bourdon tube for the translation of hydraulic capsule pressure into load. This tube and associated mechanisms control the motion of a disk through electrical contacts and collaterally the rotation of the recording drum. In this weight motor type of device, the strain motion is controlled through a Templin type extensometer, a sensitive relay and a solenoid-actuated brake. Below—Totally enclosed domestic stokers in attractive cabinets with chromium plated trimmings and finished in various colors to harmonize with basement decorations are a design of Will-Burt Co. An automatic device controls the flow of air to produce efficient combustion. Driving units operate in a bath of oil.

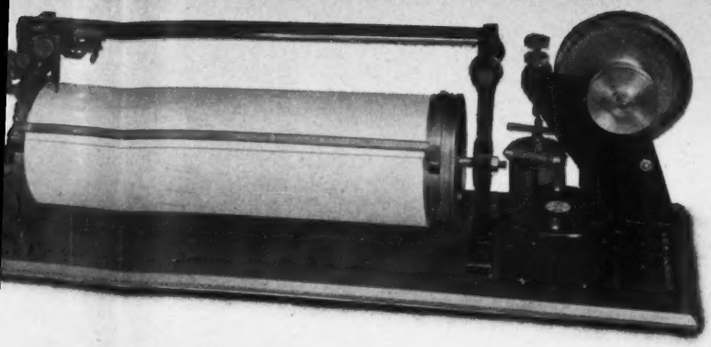


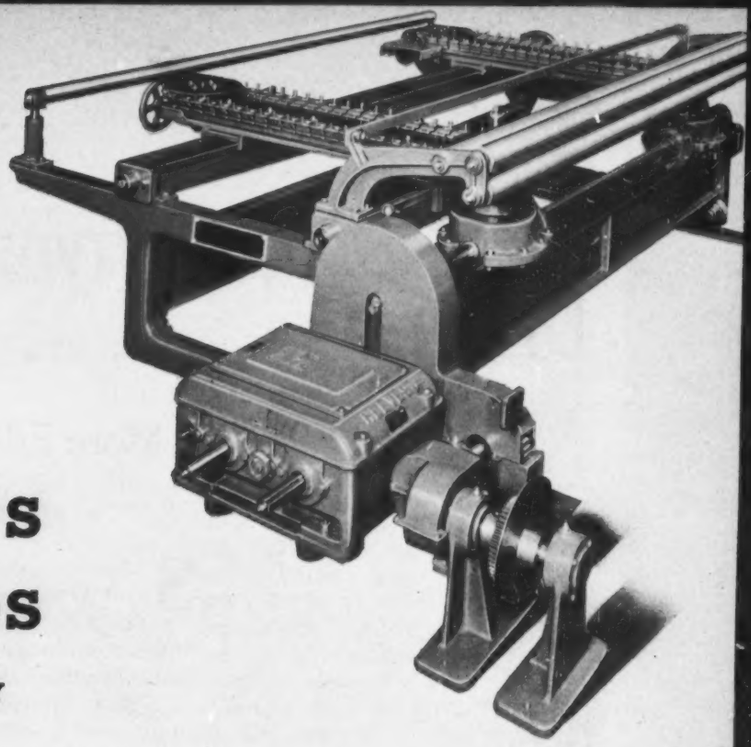
Above—Cutter-head on new Van Norn miller may be swiveled to mill vertically, h zontally or at any angle. Sliding gears and th step pulleys controlled by quick-change shift levers provide for nine speeds. Knee of machine is of box type construction to per handling of heavy loads.



Left — Straight and curved edges of sheet metal are formed through the oscillation of a short brake on the former of Engineering & Research Corp. Gearing and simple linkage of the drive mechanism are below the table, fully enclosed. Right—Rotors of concrete vibrators built by White Mfg. Co. are carried by ball bearings and driven from the engine by flexible steel shafts, encased in molded rubber hose with internal spiral steel bearing and full external steel armor. High vibration rate is obtained through a V-belt step-up and ball bearing belt-adjusting counter shaft.







Design Features in New Machines

A Pictorial Presentation of Recent Machinery from the Standpoint of Design.

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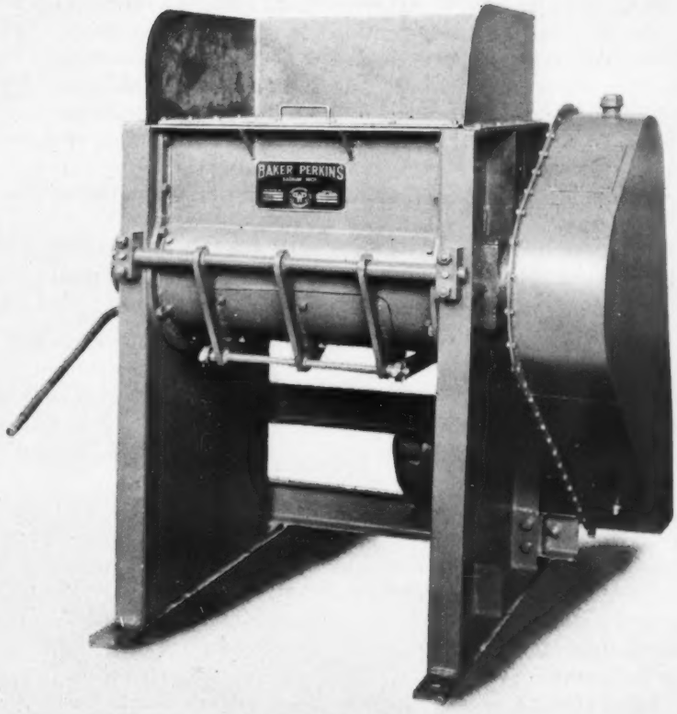
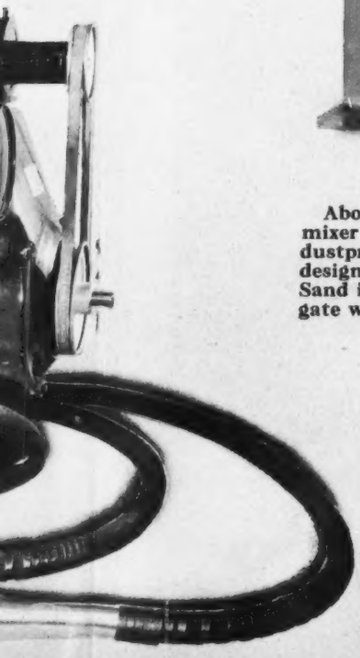


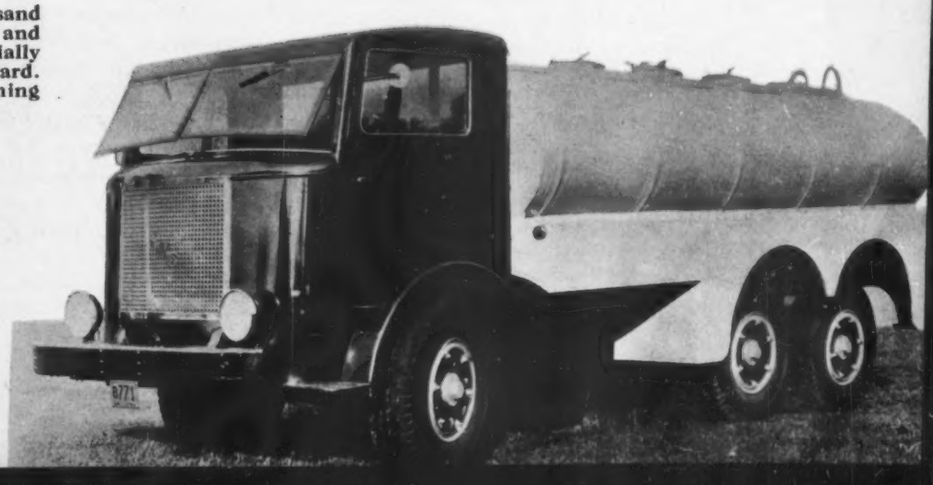
Above—Baker-Perkins Co. foundry sand mixer has all gearing enclosed in sand and dustproof housings. Blades are specially designed so as to push the sand upward. Sand is discharged through a quick-opening gate while the machine is in motion.

Above—Designed to feed the fabric straight into the Palmer finishing machine section of a Sanforizer, the tenterett of H. W. Butterworth & Sons Co. includes an improved roller chain connecting link, rigidly reinforced with roller control in the nippers. It has a stainless steel-fastened insert.

Above—To permit thorough mixing of chemical solutions and similar work, Central Scientific Corp. has produced a shaking apparatus driven by means of a gear speed-reduction universal motor mounted upon a common cast iron base with the shaking mechanism. The shaking apparatus consists of an aluminum rocker for holding the vessel.



Right—Exactly one-third of the load is carried by each of the three axles in new truck of Four Wheel Drive Auto Co. Braking force is exerted on all six wheels. The cab is set over the engine to give maximum space for payload.



MACHINE DESIGN

More Friendly Spirit Is Becoming Evident Toward High Speed Machines

STILL another cotton-picking machine finds its way to the front, and again the cry is raised that negro hand-pickers will be displaced. But this time there is less vehemence in the outcry, a more complacent attitude toward the so-called ravages of the machine having been adopted by the majority of thinkers and recorders.

More and more is the suggestion gaining ground that with the temporary shortening of the hours of labor in industry, machine capacity must be increased. Also that obsolete machines must make way for new and speedy models to permit the production of goods at a price low enough to hold the market yet high enough to yield at least some profit.

Of assurance to the public, which after all is the key to increase in confidence, are the assertions of industrial leaders to the effect that the machine creates rather than destroys jobs. Instances of the building of industries from nothing, due primarily to machine production, are at last converting the foes of machinery into friends. No longer do we need to point to the automobile, the radio, the refrigerator or the cigar as examples of machine production now employing millions, whereas employment in these industries was almost negligible thirty years ago.

Higher production, at lower cost, should still be the designer's aim. Otherwise we cannot hope for increased spending, increased wages, and a return to more normal times.

• • •

Motion Pictures in Design!

RAPID movement in machine parts has been studied visually during the past few years by means of the stroboscope. Now another inspection tool—the high speed camera—has come to the aid of the designer.

Few readers will have failed to notice the various illustrations that have been published from other fields showing the use of the motion camera in observing the action, for instance, of a golf ball at the moment of impact with a club head or of a bullet leaving the barrel of a gun. Not so many illustrations of motion study of machine parts have appeared, however, though MACHINE DESIGN has many times focused attention on the possibilities of this method of investigation.

In the current issue it is gratifying to be able to present a complete article on the subject, commencing page 13. Perusal of this contribution is recommended. The motion picture camera has played a large part in the lives of everyone; it may well play a still more important part, in another role, in the lives of engineers responsible for design.

PROFESSIONAL VIEWPOINTS

Machine Design Welcomes Letters Suitable for Publication

Designing for Appearance

To the Editor:

I HAVE just received my February issue of MACHINE DESIGN and have read the article "Designing for Appearance" by Harold L. Van Doren, and wish to say that this is just the type of article I have been looking for. I think this is a very appropriate time for such articles as this since it is now necessary to sell products on appearance as well as performance. This article has already been of service to me in my type of work. Here's hoping that you have many more articles along this line and I hope that Mr. Van Doren's articles will run in many of your future issues.

—VAN B. CHASE JR.,
Southwest Pump Co.

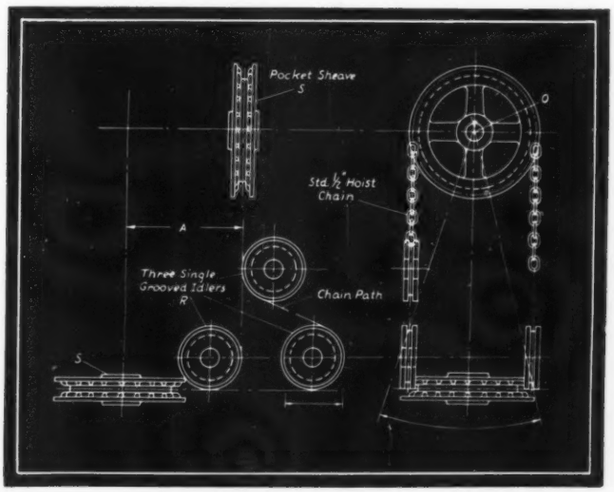
Providing a Right-Angle Drive

To the Editor:

WE WERE recently confronted with the problem of providing a right-angle positive drive, as shown, in which we had to anticipate a change in the dimension *A* as well as to allow for rotation of the driven member about point *O*. For the solution, we borrowed from the principle of the chain hoist, using two stock pocket sheaves, *S*, and the three grooved idlers, *R*, arranged two on the tight side and one on the slack side of the chain.

The chain engagement with the pocket sheave provides the positive drive and the symmetry of the standard chain used allows the perpendicular application. The idlers, which are steel disks with a groove cut along the periphery, provide a fulcrum and guide for the chain. The two idlers on the tight side provide the required flexibility in dimension *A*. It is apparent from the sketch that the driven member may rotate about *O*.

—C. LUDWIG,
Hazelett Metals Inc.



Right-angle positive drive is provided by arrangement of chain sprockets

They Say—

"The automobile has not only created millions of automobiles, but a fact often lost sight of is that it has also created the money which has been paid to you and me with which we bought those same automobiles."—William B. Stout.

□ □ □

"Only by co-operating with its manager can any group of society be successful in its plans, and only by co-operating with its manager (the President) can society progress and achieve recovery."—George P. Torrence.

□ □ □

"So I say that what's happening to agriculture and to industry is happening in the laboratory, not in AAA or NRA or in any agency of government."—Henry Ford.

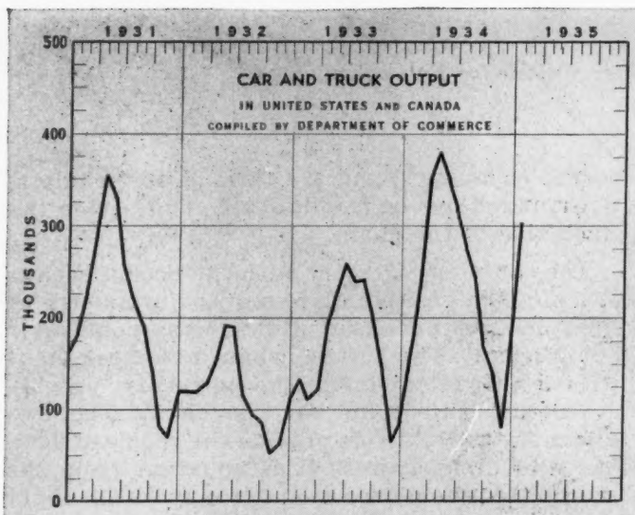
□ □ □

"With the increased use of electricity and consumers' goods in general, capital goods must also increase. For the year 1935, we look forward to a continued improvement in business."—Gerard Swope.

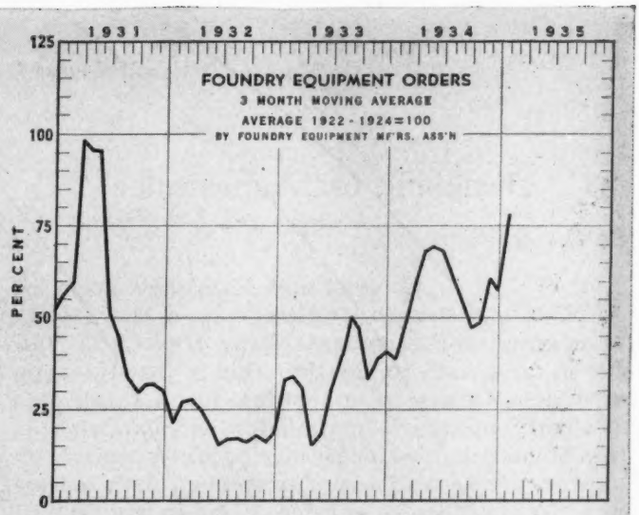
□ □ □

"Business and government are beginning to pull together. The load is beginning to move. As these two forces learn to work in harmony under the new conditions, marked improvement in economic conditions may be expected."—A. W. Robertson.

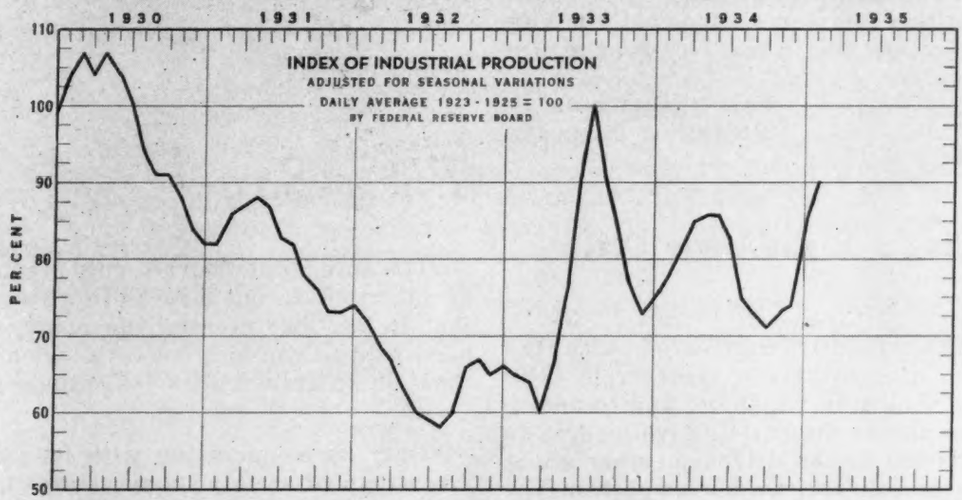
How Is Business?



January 1934, 132,283—*January* 1935, 303,372

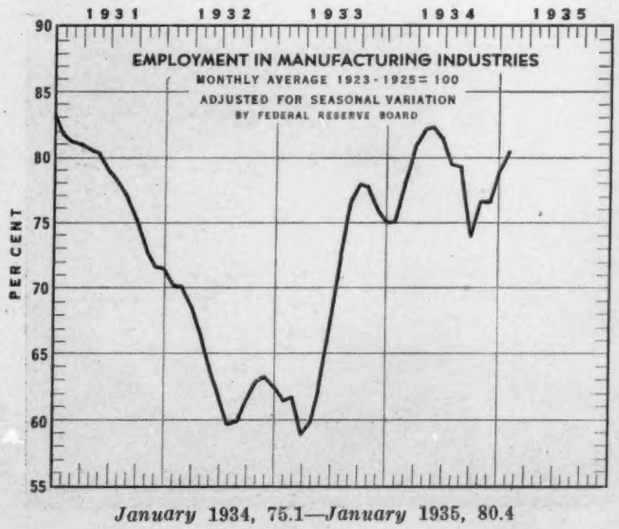


January 1934, 39.2—*January* 1935, 78.0



January 1934, 78—*January* 1935, 90

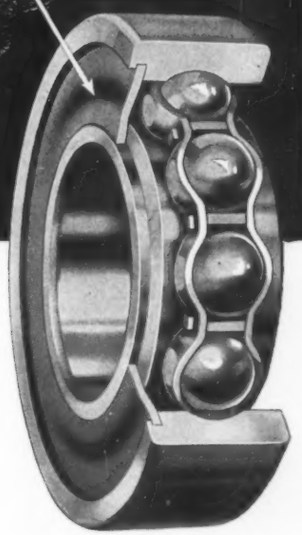
January 1934, 56.5—*January* 1935, 61.3



January 1934, 75.1—*January* 1935, 80.4

ORIGINAL SEALING EFFICIENCY HELD PERMANENTLY

The rigid shield construction of M-R-C Lubri-Seal Ball Bearings permanently maintains the close shield clearances built into them. Three types are available—Single-Row single-shield, Single-Row double-shield and Double-Row single-shield. The satisfactory performance of millions of these M-R-C Lubri-Seal bearings for over thirteen years is positive proof of their sealing efficiency.



M-R-C LUBRI-SEAL BALL BEARING

Heavy gauge metal shield, firmly swedged into outer ring . . . no contacting of moving parts . . . close shield clearances maintained for life of bearing.

MARLIN-ROCKWELL CORPORATION

Executive Office: JAMESTOWN, N. Y.

Factories: Jamestown—Plainville, Conn.—Chicago

Leadership

M-R-C Strom SRB GURNEY BALL BEARINGS

M-R-C

BALL BEARINGS

MEN OF MACHINES

CHIEF engineer of the commercial refrigeration division of Servel Inc. now is Clyde E. Ploeger. His appointment is a further step in the unifying of all activities within the commercial division.

A native of Evansville, Ind., Mr. Ploeger attended Purdue university, graduating in 1923 with an electrical engineering degree. Soon after that he became affiliated with Servel. For the past several years he has served as research engineer in the electrical division.

Ploeger's activities have centered around the development of nearly every Servel product in the electric division within the last ten years. His most notable work is embodied in the development of a forced draft convection unit and air conditioning equipment.

C. E. PLOEGER

• • •

ANOTHER engineer to assume new responsibilities is John G. Zummach. In his present capacity as chief engineer of the Hexcel Radiator Co. he takes full charge of all engineering and management of its commercial and air conditioning branch.

Born in Milwaukee, Nov. 18, 1888, Mr. Zummach after attending public school, trade school and college, served an apprenticeship with Allis-Chalmers Mfg. Co. He subsequently went into the engineering department of A. O. Smith Corp. where he remained for five years.

In 1918 Mr. Zummach joined the Perfex Radiator Co. as chief engineer and assistant to the president. His work involved the designing of intricate special machinery. From 1924 until 1929 he headed the Husky Wrench Co. which he helped organize.

J. G. ZUMMACH

• • •

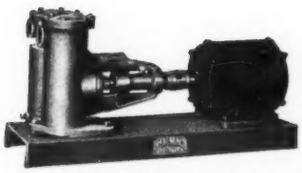
IN RECOGNITION of his conspicuous achievements as chief engineer in charge of motor truck enginering for International Harvester Co. since 1927, A. W. Scarratt recently was advanced to the position of chief engineer over all the company's automotive engineering activities. He also will have charge of engineering on tractors and power plants.

From 1914 to 1926 he was prominently identified with tractor design. Prior to that Mr. Scarratt was engaged in railway engineering. He came to the Harvester organization in 1927, having subsequently occupied the position of chief engineer of Hyatt Roller Bearing Co.

Particularly noteworthy is the development under Mr. Scarratt's direction of the streamlined International C trucks. For

A. W. SCARRATT

PERFORMANCE



The New Burks Self-Priming Centrifugal Pump equipped with Emerson integral h. p. Polyphase Motor which is featured in this announcement.

SIMPLICITY— PLUS

The Decatur Pump Company, Decatur, Ill., manufacturers of Burks Pumps, after years of research and experimenting, finally designed a pump so simple that it has but a single moving part. Likewise, the Emerson Electric Mfg. Co.—to match the simplicity of Burks Super-Turbine Pumps—designed a motor with the fewest parts practicable. "Now—we'll prove the advantage of simplicity," said Decatur engineers. They did—with a six year factory test run. The result? Unfailing performance—only negligible wear—and NO REPAIRS!

For almost half a century Emerson has developed and manufactured motors for hundreds of different types of appliances, machines and tools, in widely diversified fields and industries.

Because of this specialization, and because of continual research and experimental work, Emerson has been highly successful in reducing motor wear, motor noise, vibration and operating cost—and in producing motors that render long years of trouble-free service. Every Emerson Motor is specially built for the job it has to do—with *balanced performance*—without a single "weak spot."

In the final analysis, however, performance is best indicated by technical data. We have a series of charts which show the essential performance characteristics (torques, efficiencies, etc.) of the various types of Emerson Motors. Write for this information, and Booklet 5M TODAY.

EMERSON MOTORS

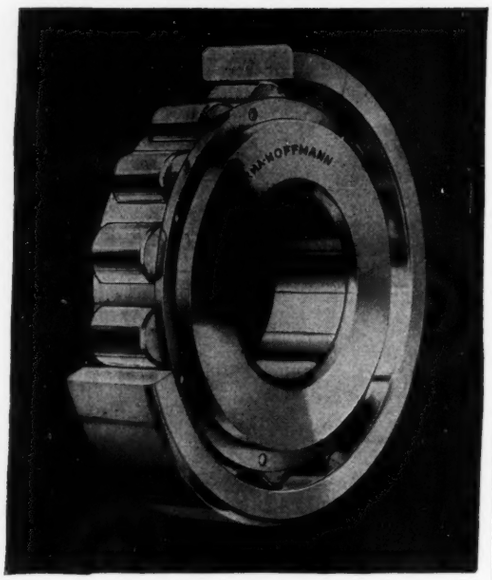
3 HP and smaller—Single-phase—Polyphase—Direct Current

THE EMERSON ELECTRIC MFG. CO.

NEW YORK ST. LOUIS CHICAGO

LEADERS IN THE FAN AND MOTOR INDUSTRY SINCE 1890

For SEVERE RADIAL and SHOCK LOADS



PRECISION ROLLER BEARINGS afford—for extreme load conditions—the following outstanding advantages . . . Solid, cylindrical rollers, held to infinitesimal limits of accuracy, provide larger steady load and shock capacity than any other single-row bearing, together with a temporary overload capacity of 50% . . . Short roller construction affords ideal load distribution and greater wear resistance . . . Extruded bronze, machined and balanced, heavy-duty retainer is land-riding, relieving the rolling elements of its weight . . . Extreme refinement of design and finish gives a lower coefficient of friction under severe load than any other type of bearing and permits speeds up to 35,000 R.P.M. . . . PRECISION ROLLER BEARINGS interchange in size with all standard ball bearings . . . Write for the catalog. Let our engineers work with you. . . . . .

"NORMA-HOFFMANN"
PRECISION BEARINGS
BALL. ROLLER AND THRUST

NORMA-HOFFMANN BEARINGS CORP. STAMFORD, CONN., U. S. A.

a number of years he has been active in the Society of Automotive Engineers, and has served as a member of its motor coach and motor truck committee and also the lubricants division committee.

* * *

DR. LILLIAN M. GILBRETH, management consulting engineer, has been appointed professor of management at Purdue university, effective next September. She is one of the few women admitted to a membership in the American Society of Mechanical Engineers.

* * *

HARRY HARRISON recently was elected president of the American Society of Refrigerating Engineers. He is connected with the Philadelphia office of Carrier Engineering Corp.

* * *

THOMAS E. LORD of Detroit has been appointed engineer for the National Tool Co., Cleveland.

* * *

AMBROSE SWASEY is the recipient of the Washington Award for 1935.

* * *

R. C. HAIMBAUGH, formerly refrigerator engineer with Grigsby Grunow Co., has joined Atwater Kent Mfg. Co.

* * *

ROBERT TREAT PAINE II, for forty years director of the General Electric Co., has resigned because of ill health.

* * *

THOMAS W. PANGBORN, Pangborn Corp., Hagerstown, Md., recently was re-elected president of the National Founders' association.

* * *

DR. W. H. HATFIELD, director of research at the Brown-Firth research laboratories and a member of the council of the British Iron and Steel institute since 1927, has been elected a vice president of the institute.

* * *

MAURICE A. THORNE recently was appointed projects engineer of Oldsmobile. He comes to the organization from the Patent Engineering Corp., New York, with which he was affiliated as a consulting engineer.

Obituaries

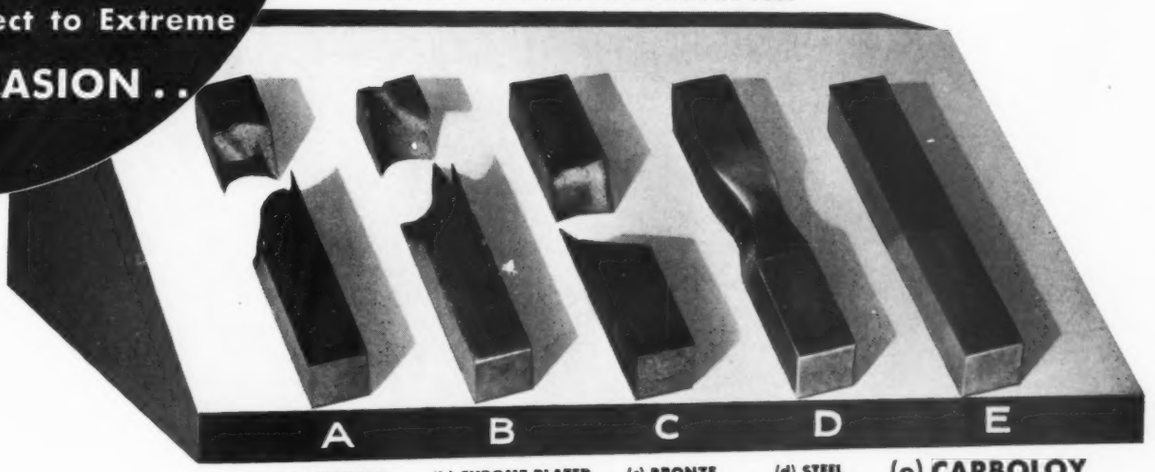
DR. HUGO JUNKERS, noted airplane and engine builder, is dead. His passing, on his seventy-sixth birthday, followed an operation in Munich, Germany. Dr. Junkers was a pioneer in building all-metal planes. The day following his death marked the twenty-fifth anniversary of the granting of a patent on his first metal motorplane.

* * *

CHARLES S. CRAWFORD, former chief engineer of the General Motors Opel plant in Germany, died recently. At one time he was chief engineer of Stutz, Cole and Premier. He left Stutz to join the GM Export Corp., which eventually led to his Opel appointment. Mr. Crawford was a brother of J. M. Crawford, Chevrolet chief engineer.

Here's the Comparative Wear on 5 Different Metals After Being Subject to Extreme ABRASION . .

Result of a 40-Minute Sand Blast Test



(a) NITRIDED 950-1050 Vickers B. H. (Depth .020" per side) | (b) CHROME-PLATED (Depth .010" per side) | (c) BRONZE (32 Rockwell "C") | (d) STEEL (65 Rockwell "C") | (e) CARBOLOY (92.5 Rockwell "A")

For Long Economical Life On Parts Subject to Rapid Abrasion, Use CARBOLOY*

Using steel shot No. 72 at 100 lbs. pressure, the five metal bars shown above were blasted for a period of 40 minutes to determine relative wear. In those cases where the bar parted before the full 40 minutes elapsed, the test was stopped. This occurred on the nitrided bar after 23 minutes, the chrome-plated bar after 23½ minutes and the hard bronze bar after 11¼ minutes. The hard steel bar stood up the entire 40 minutes but at the end of that period had lost 50 per cent of its thickness at the point of blast. In contrast to the above, the Carboloy bar showed no sign of wear with the exception of a slight dullness on its surface finish.

Carboloy is particularly economical for abrasion resistant purposes because of its extreme hardness—its hardest grade rating about 92.5 Rockwell "A". It is also suitable for application on parts subject to corrosion due to its high resistance to acids and alkalies.

The application of Carboloy to your parts is extremely simple. Just recess your part at the point of rapid wear and braze in a small insert of Carboloy. Long life, less machine down time, less replacement cost and longer periods of efficient operation are among the benefits you receive. Pin a sketch of your part, indicating point of wear, to the coupon below for specific information. No obligation.

CARBOLOY COMPANY, INC.
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CHICAGO · CLEVELAND · PHILADELPHIA · NEWARK · PITTSBURGH
CANADIAN DISTRIBUTOR
Canadian General Electric Company Limited, Toronto, Ontario

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Carboloy Company, Inc.
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Send your free 16-page booklet showing how we can reduce wear with Carboloy inserts.

Name_____ Title_____
Company_____
City_____ State_____

REDUCE WEAR ON THE EQUIPMENT YOU *USE* AND THE EQUIPMENT YOU *MAKE*

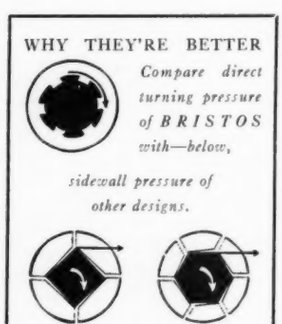
No bigger than match ˙p

One of several standard sizes under ¼ inch diameter

Setting up a BRISTO Set Screw is easy. Because of the gear-like action with which the BRISTO Wrench meshes into the fluted socket, there is no fumbling. Or bother or trouble, even in handling the smallest sizes.

Once set, a BRISTO stays set. It will not shake loose. Neither will the socket jam, round out or split. See diagram. BRISTO design withstands all the force needed for a tight grip.

Write and ask for *free samples* of BRISTO Set and Cap Screws.



THE BRISTOL COMPANY, WATERBURY, CONN.

Branch Offices: Akron, Birmingham, Boston, Chicago, Denver, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis, San Francisco

TRADE MARK

BRISTO

REG. U.S. PAT. OFF.

Socket **SET SCREWS**

Socket Head **CAP SCREWS**

TOPICS OF THE MONTH

DESIGN will play the leading role in the industrial arts exposition to open April 15 at Rockefeller Center in New York. Sponsored by the National Alliance of Art and Industry, the exhibit is being carried out according to plans executed by Thomas J. Maloney. Requirements of the average man, including housing, domestic appliances, transportation, communication, etc., will provide the basis for the varicus exhibits.

* * *

Announcement recently was made that Engineering Index Inc., will appeal to the nation's industry operating in technical fields for a working capital of approximately $160,000 with which to continue the service and spread its use throughout engineering offices, libraries and colleges. After a five-year period the service is expected to be self-sustaining.

The Index is a complete catalog with annotations of technical literature in all engineering branches. It is published as an annual volume and as a card service which is an accumulative card index of technical literature sub-divided into approximately 280 divisions. About 2000 publications from 40 different countries and in 20 languages are reviewed yearly by Index editors.

* * *

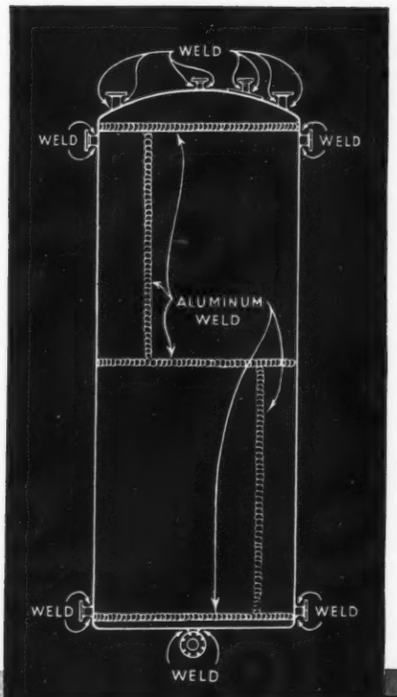
Concurrent with the prominence MACHINE DESIGN has given to plastics as a new engineering material comes a comment by C. C. Concannon, chief of the chemical division of the department of commerce. He sets forth that the synthetic resin industry of the United States now has reached the point where it ranks as one of the country's important manufacturing enterprises. Originally an American achievement, he points out that the United States leads today in the chemistry of synthetic resins and is the world's largest producer and consumer.

* * *

Boulder Dam embodies a new mechanical achievement consuming tons of engineering materials and parts. One of the more recent contributions to this gigantic feat was made by Bantam in furnishing the conical thrust bearings together with aligning seats on the cylinder gate hoist for the four intake towers. One gate hoist will be mounted on the floor of each of the four intake towers and will be used to operate separately or simultaneously the two cylinder gates installed in each tower.

Cylinder gates will be mounted one above the other in the vertical shaft of each intake tower

Design for OXWELDING *and specify the Best*



A LONG successful record of chemical equipment designed for oxwelding and built with the advice and assistance of Linde Process Service is reflected in the following quotation from a chemical firm's specifications for six large aluminum tanks:

"Welding is to be by the oxy-acetylene process using Oxweld Aluminum Welding and Oxweld Aluminum Flux . ial care is to be taken as the tank is to contain acid. The approval of each welder must be obtained through a qualification test from The Linde Air Products Company before welding is done."

Before planning equipment this firm has regularly obtained from Linde the latest data on performing the specific welding job and specifications have been drawn to require techniques, materials, and testing methods proved in the vast experience of Linde Process Service. In this way the soundest, strongest, most economical fabrication is assured.

You can have this in your equipment too, by simply taking advantage of Linde Process Service. The nearest Linde Sales Office will be glad to explain this service to you. Phone or write now.

• • •

Continuing previous records for service, Linde advised on the correct type of oxwelded joints and the welding materials for building these 3000-gal. aluminum tanks. Every seam was leakproof under hydrostatic test. All welders were rigidly qualified by Linde.

PRODUCT OF A UNIT OF UCC UNION CARBIDE AND CARBON CORPORATION

THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

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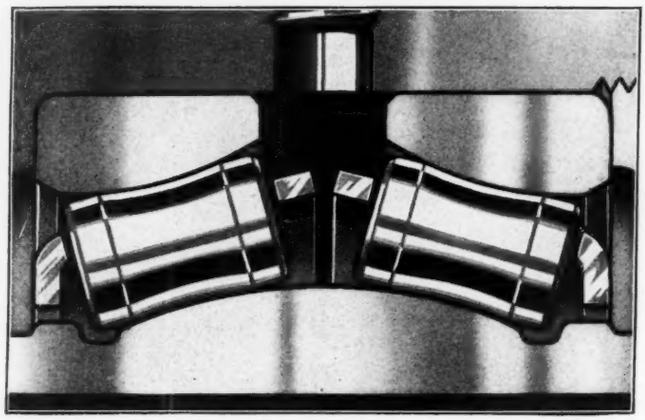
LINDE OXYGEN • PREST-O-LITE ACETYLENE • OXWELD APPARATUS AND SUPPLIES • UNION CARBIDE

Free rolling



...EXTRA friction-free performance under all conditions—(misalignment, shaft deflection, shock loads, even inaccurate mounting)

..PLUS generous capacity for radial and thrust loads

..PLUS long, dependable service life, can be obtained in a single compact bearing—the Shafer self-aligning roller bearing. • The exclusive CONCAVE roller design combines radial-thrust capacity and natural self-alignment without added bulk, or extra cost.

Available in a full range of sizes:

Pillow Blocks • Flange Units • Take-Up Units
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Conveyor Rolls • Radial-Thrust Roller Bearings

Catalog No. 12 gives complete data. Write for your copy.

SHAFER
self aligning
ROLLER BEARING
UNITS

SHAFER BEARING CORPORATION
6513 WEST GRAND AVENUE • CHICAGO, ILL.

and will be employed as shut-off gates for the thirty-foot diameter penstocks extending from the base of each tower to the power plant and outlet works. These conical roller thrust bearings which will support the two bronze lifting nuts that engage the threaded ends of the stems to raise and lower the upper and lower cylinder gates have a load carrying capacity of 1,000,000 pounds at operating speeds.

* * *

The three millionth Frigidaire came down the production line at the Dayton, O., plant last month. Just another indication of the important place the refrigeration equipment industry has attained.

* * *

It is significant that at a recent open house celebration held by Allis-Chalmers Mfg. Co. at its plant in Milwaukee 30,000 visitors got an inside picture of a large industrial plant. General Otto Falk, board chairman, Max. W. Babb, president, and other executives welcomed the guests. Exhibits ranged from small motors to gigantic turbines.

* * *

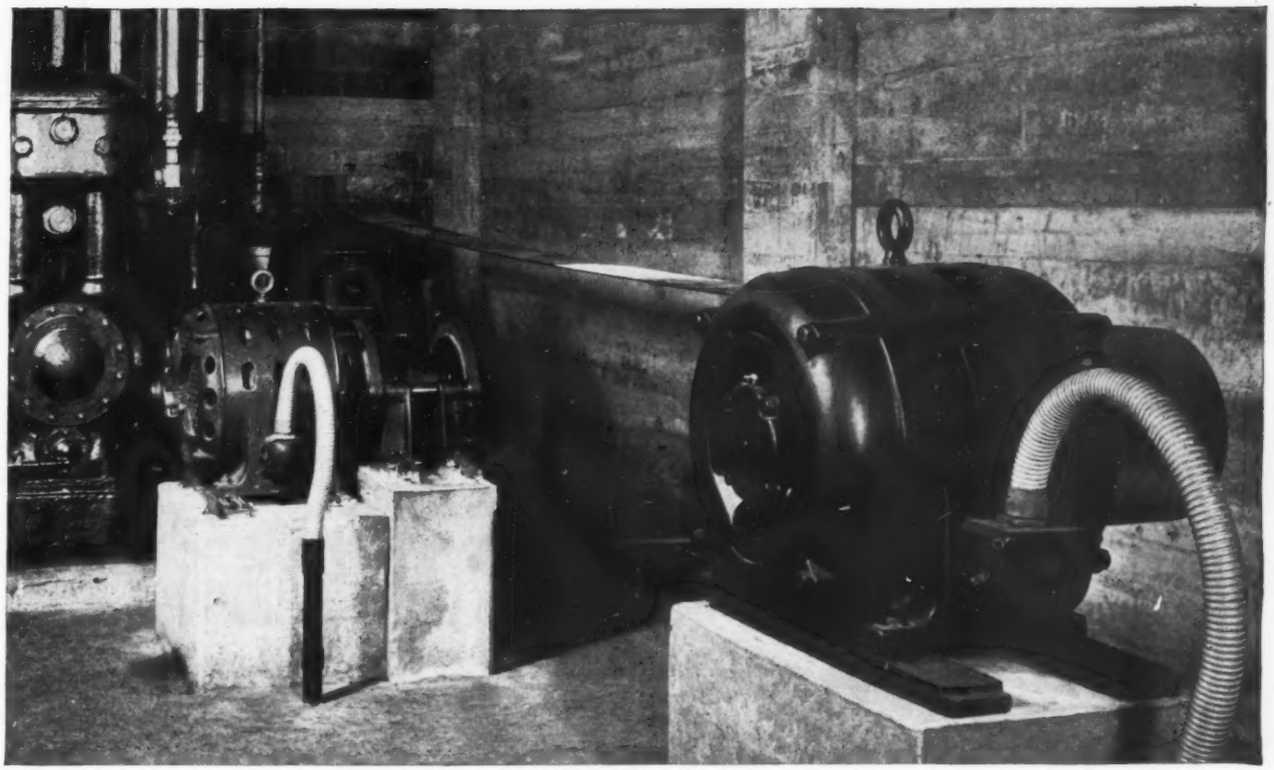
Reports from the automotive industry disclose that Chevrolet led the entire industry in 1934 in passenger car and truck registrations. The company sold 534,906 cars and 157,507 trucks. This record has been achieved by Chevrolet for four consecutive years. It also is interesting to note that knee action wheels, offered this year as optional equipment on the Chevrolet master de luxe line at $20 additional cost, are specified in 90 per cent of the orders for cars.

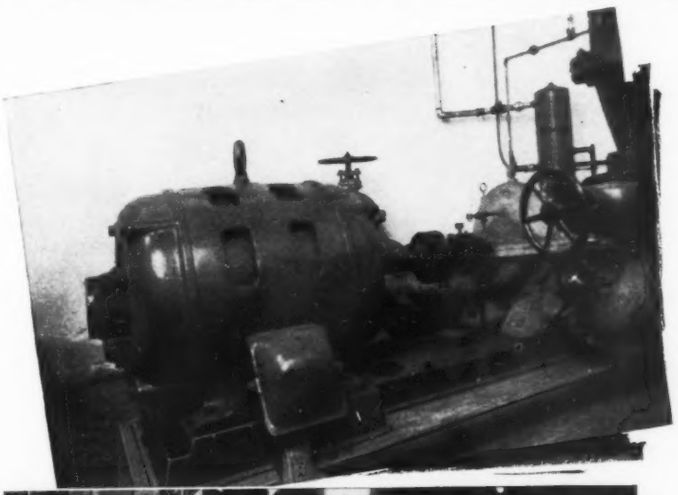
* * *

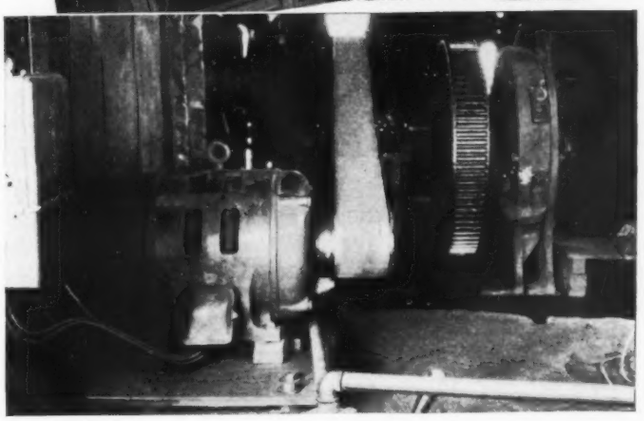
Regent maroon, a very dark and heavy shade, is the leading color preferred this year for motor cars. This fact was disclosed as the result of a questionnaire conducted by Automobile Color Index and sent to approximately one thousand automobile executives, designers, dealers and advertising men. Second choice was Regimental blue, also a dark, heavy shade and third choice was Kakhoda blue, with black in fourth place. Oxblood red was fifth.

* * *

Rapidly the new relation of economics to engineering gains impetus in colleges and universities. At Rensselaer Polytechnic Institute interest in this phase of education has been reflected first by emphasis upon the economic factors involved in engineering problems; in provision for courses in economics and business administration for students in engineering; and in development of curricula in business administration and industrial engineering leading to degrees.







125 H. P. Century 3-Phase, 220/440 Volt, 60 Cycle Motor, Belt Connected to Steel Ball Roller.

75 H. P. and 25 H. P. Century 3-Phase, 220 Volt, 60 Cycle Motors, Belt Connected to Ammonia Compressor in Cold Storage Plant.

125 H. P. Century 3-Phase, 2200 Volt, 60 Cycle Motor Direct Connected to Centrifugal Pump.

BIG MOTORS *for* BIG JOBS

The illustrations on this page are typical of the many heavy-duty installations where Century Motors are steadily doing a big job—constantly meeting the severe shocks, strains and stresses imposed by belt, chain, gear or direct drives . . . Sizes up to 600 H. P. . . Consult Century Engineers —Investigate Century Big Motors for Big Jobs —"They Keep a-Running."

Splash Proof • Multispeed • Slip Ring • Direct Current

CENTURY ELECTRIC COMPANY
1806 Pine Street St. Louis, Mo.
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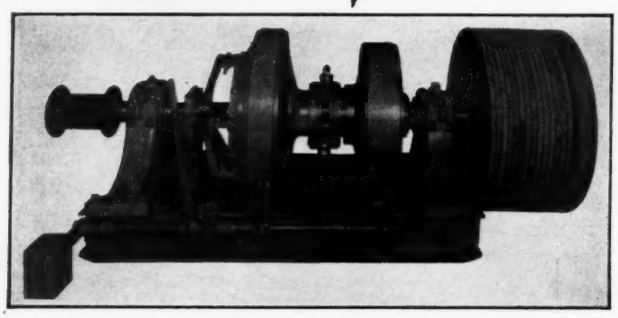
Century MOTORS

BIG CLUTCHES FOR HEAVY DUTY

No. 7444—1 Plate 42-SS Toggle Action Twin Disc Clutch



This draw works of the Portable Rig Company, Houston, Texas, requires a clutch that is at once powerful and reliable. The 42 inch single plate, toggle action Twin Disc Clutch, with which it is equipped, is designed for such heavy duty at moderate speeds. All sliding elements are contained in the clutch itself. The driving plate, also the hub, is rigidly connected to the driving member and driven shaft respectively. There are more than 400 types and sizes of Twin Disc Clutches—the development of seventeen years of clutch specialization. *Write* for engineering data. Specific recommendations on request. *Twin Disc Clutch Company, 1325 Racine Street, Racine, Wisconsin.*

TWIN DISC CLUTCHES

NOTEWORTHY PATENTS

TO PREVENT derangement of the wrapper in preparing gum for packaging, a machine *Fig.* 1, has been designed and patented that employs novel and improved means for stacking the individual sticks or pieces of gum after the labels have been applied. A rotary tumbling barrel or wrapping drum 2 receives the individual pieces of gum 1 that have been wrapped previously in paper-lined foil. Each piece of gum carries with it a label to be applied, into a slot 4 so that the label is positioned over the inner edge and the two sides of the gum. One edge portion 6 of the label projects beyond the outer edge of the gum.

During rotation of the drum this projecting portion of the label by engagement with a curved

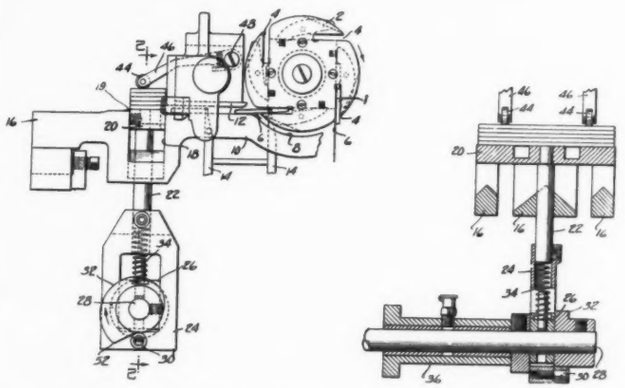
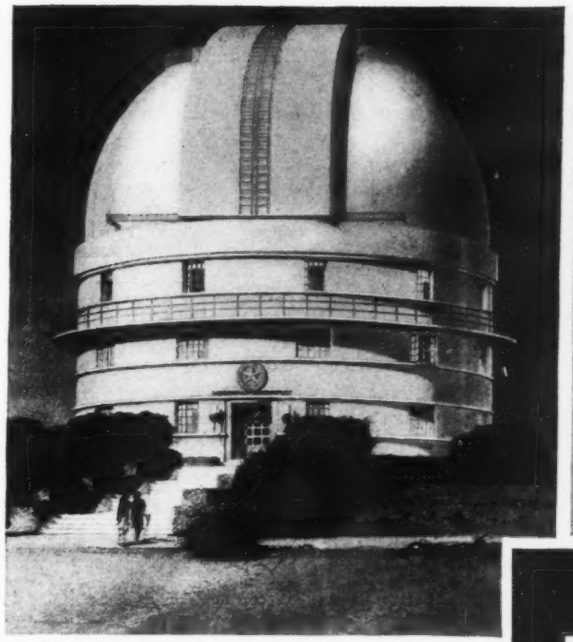


Fig. 1—Gum wrapping machine embodies a series of interesting mechanical movements to carry out a process

guiding surface 8 on table 10 is bent over the outer edge of the gum. As each piece of gum reaches the plane of the table it is ejected from the slot and fed over the table. When the piece of gum thus is moved edgewise over the table the projecting edge of the label is brought up into overlapping engagement with the other edge of the label, adhesive previously applied securing the edges together.

The pieces of gum are fed in spaced relation beneath a guide bar 12 by members 14, these members also serving to eject the pieces from the wrapping head 2. At the start of opera-



McDonald Observatory in which the Warner & Swasey Timken-equipped 82″ telescope will be installed.

Astronomical Accuracy for Machine Tools

THERE is no finer example of precision construction than the modern astronomical telescope. These complicated instruments, although weighing many tons, operate with greater accuracy than the finest watch as they automatically and constantly follow the heavenly bodies in their courses.

Telescope manufacturers are precision conscious to a degree hardly appreciable by the lay mind. One of the oldest and most prominent of these manufacturers is the Warner & Swasey Company, Cleveland, Ohio. Some of the world's most famous telescopes have been built by this organization. The latest, now under construction, is the McDonald Observatory telescope—second largest reflecting telescope ever constructed (82″ mirror).

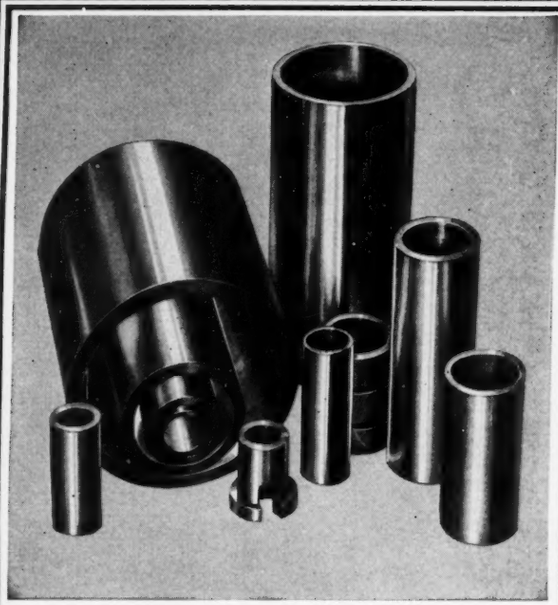
In industrial circles the name of Warner & Swasey is, perhaps, better known in connection with the manufacture of heavy duty machine tools—where the application of telescope precision has won for them a world-wide reputation.

Nobody knows better than Warner & Swasey the importance of bearings in obtaining and maintaining the extreme accuracy required in both telescopes and turret lathes. The selection of Timken Tapered Roller Bearings for both types of equipment is the tribute of one precision manufacturer to another.

Timken Precision Bearings used in the McDonald telescope. They are installed on the declination sleeve and the main driving worm gear in right ascension. The largest bearing has a bore of 43″ and an outside diameter of 52″. Previous to this no bearing had ever been made with a bore of more than 42″. The 62 foot diameter, 150 ton revolving dome which will enclose the telescope also operates on Timken Bearings, a total of 52 bearings being used in the 26 huge track wheels.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

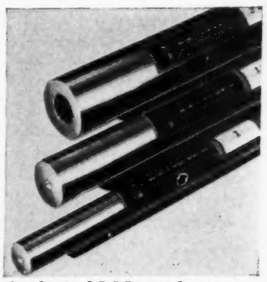
TIMKEN TAPERED ROLLER BEARINGS



INSTANT DELIVERY

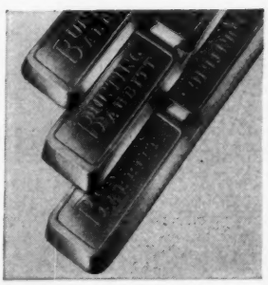
THE very day your need for bearings arises you can procure the bearings you require from Bunting's great stocks of "Ready Made" completely machined and finished (ground O.D.) bronze bearings. There are over 500 different sizes meeting every usual application. Stocks are carried at all Bunting branches. Write for list giving dimensions and prices.

Better Bars



Absolute uniformity and the maximum of physical properties are assured in Bunting cored and solid bronze bars by an inflexibly standardized casting technic and constant laboratory control. Cast in 13" lengths. Machined and centered. Ask us or your mill supply wholesaler for list of 121 stock sizes.

Better Babbitt



It is the experience of users that nothing else has ever been developed for general industrial use that equals Bunting Babbitt. It provides the lowest coefficient of friction on record. Ask your mill supply wholesaler.

THE BUNTING BRASS & BRONZE COMPANY, TOLEDO, OHIO
Branches and Warehouses in All Principal Cities

BUNTING Quality
BRONZE BUSHINGS • BEARINGS
MACHINED AND CENTERED BRONZE BARS
ANTI-FRICTION METAL

tion of the machine support 20 is positioned substantially level with the top surface of table 10. As the first piece of gum is delivered from the wrapping head it passes beneath guide rolls 44 and upon support 20. As the first piece is deposited on support 20 a cam 32 lowers the support so that the next piece of gum is fed similarly over table 10 and against abutment 19, this piece being accurately positioned over the first piece.

Support 20 continues to be lowered as the other pieces of gum are delivered until a total of five pieces are positioned on the support. When the pieces have been thus stacked the cam roll 30 rides off the point 52 of the cam 32, whereupon the spring 34 acts immediately to elevate the support to position its top surface and the underside of the lowermost piece of gum slightly above the top of abutment 19 as shown in the drawing at left in *Fig.* 1.

It will be noted that the lower end of rod 22 is secured to yoke 24 which embraces and is mounted to slide on block 26 that is loosely positioned on rotating shaft 28. Yoke 24 carries cam roll 30 held in engagement with cam 32 secured on the end of shaft 28, by means of coiled spring 34 interposed between the upper side of block 26 and the lower end of rod 22.

Suitable devices (not shown) then act to carry the stack of gum off the support and from beneath rolls 44 and deliver them to the usual mechanism for wrapping the label about the stack to complete the package. Albert Kneaskern is the inventor of the machine and Beech-Nut Packing Co. the assignee. Number of the patent is 1,985,832.

A CONTROLLABLE clutch in which shot is employed in effecting the transmission of driving force is the subject of a patent granted recently to Wade H. Wineman and assigned to Sullivan Machinery Co. When the unit. *Fig.* 2, is

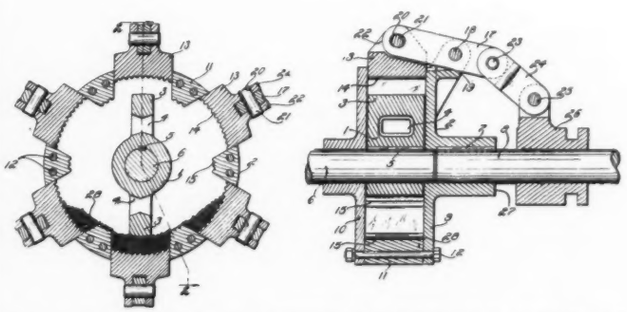
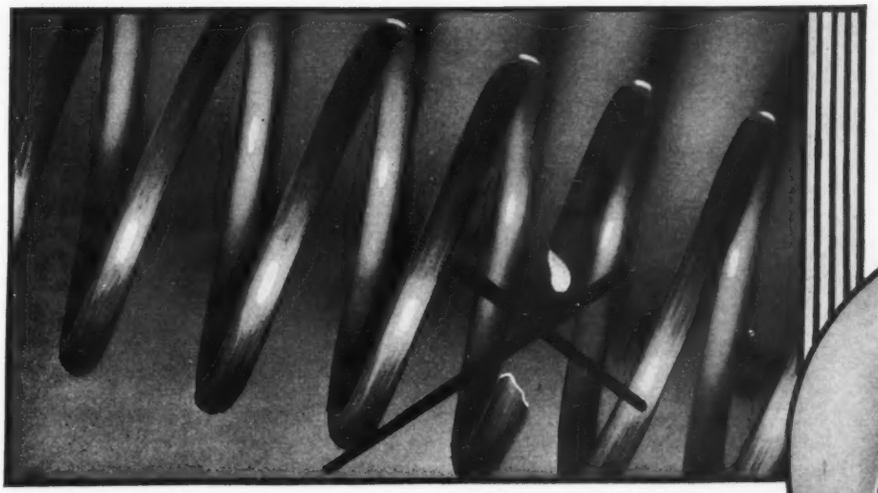


Fig. 2—Chilled shot acting under the influence of centrifugal force controls action of clutch parts

at rest and the elements 13 are in their extreme innermost positions, the chilled shot will lie at the bottom of the shell. On starting a motor driving shaft 6, the impeller blades 3 revolve within the casing, driving the shot before them until a speed is reached at which centrifugal force will



Photograph of spring coil which has failed in service due to over-stress. Proper allowance for unavoidable variation in commercial wire stock would have eliminated the error.

ELIMINATING SPRING FAILURES

THE fact that springs play an important part in almost all machinery operation—and that uninterrupted performance depends entirely upon their ability to function without mishap—calls for careful and specific study of two important factors; correct design and correct application.

CORRECT design pertains not only to size and shape of the spring—as applying to the variable portion of stress—but, also, to load deflection characteristics due to any one of several reasons. Correct application means perfect coordination between spring and machinery designers—the development of an improved type of spring to eliminate trouble and failure in an existing product—or the planning of a new machine so as to assure sufficient space and other factors vital to efficient spring usage. It is the proved ability of the American Steel & Wire Company to properly design springs—and to assist in their correct application—that has made this source of supply the recognized leader.

American QUALITY Steel & Wire Company **SPRINGS**

AMERICAN STEEL & WIRE COMPANY

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act to pack the shot down to cause the impeller to pick up the shell and revolve it.

At normal driving speed the shot accumulates to such an extent that the impeller becomes in effect locked to the shell. Overloading is cared for by reason of the fact that when this condition arises a reduction in speed takes place with the result that centrifugal force is reduced and slipping takes place.

When it is desired to discontinue driving without stopping the motor the clutch shipper member 26 may be moved to the right, resulting in a withdrawal of members 13. Consequently the shot is received within pockets 4 thus formed and the drive is interrupted. Openings 4 when present tend to permit the shot which accumulates in front of the blade prior to actual initiation of full speed driving, to slip through to the rear sides of the blade, thereby reducing wear and facilitating freedom of motion at low speeds.

The patent is designated 1,984,389.

UTILIZING complementary grooves in a shaft and sleeve, a recently patented device provides a mechanism for converting rotary motion into reciprocating movement. The design, as disclosed in *Fig.* 3, embodies a sleeve 10 provided with a series of cam grooves 24 in which balls or rollers are adapted to have relative movement. Spacing member 18 of thin sheet metal is employed to carry balls 20.

The external surface of the shaft is designed with co-acting grooves 25 which are similar in size and shape to grooves 24. The rollers or balls drift laterally back and forth as one part, either the shaft or sleeve revolves to cause reciprocating motion in the other. The patent for this device was taken out by Thomas O. Liles, assignor to Lilesmotor Corp., Dallas, Texas. No. 1,985,901 identifies it.

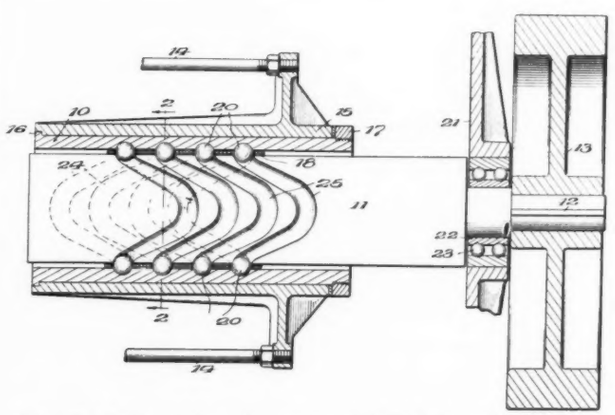
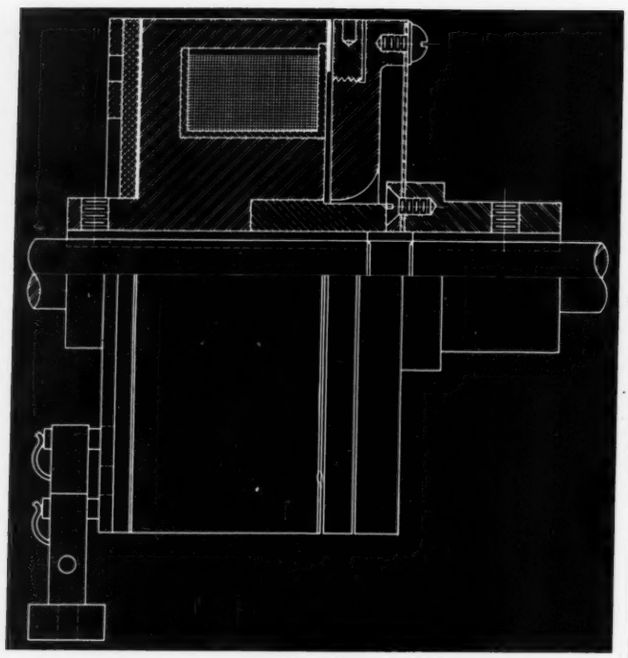


Fig. 3—*Balls acting in grooves translate rotary into reciprocating motion or vice versa*

BACKLASH is eliminated in differential gearing designed by H. C. Ford to whom a patent recently was granted. In precision instruments employing differentials this accomplish-



DINGS TYPE SD-C

MAGNETIC CLUTCHES

Where small clutches are needed!

NOW designers can figure on a small magnetic clutch provided with an adjustment for wear.

The Dings SD-C is furnished in sizes from 4 to 7 inches and is provided with a take-up adjustment that cares for the problem of wear. It is strongly built. The friction linings are large in area and cannot be reached by oil. Operation is cool. The coil is permanently anchored in a cast aluminum spool located in the steel magnet body member. Quick engagement and disengagement is assured.

It is simple. There is nothing to get out of order. It is positive in action and provides the solution of problems involving remote control, safety and the synchronization of two or more units.

Every designing engineer with a clutch problem should secure complete information. There is no obligation in asking our help.

EXPERIENCE

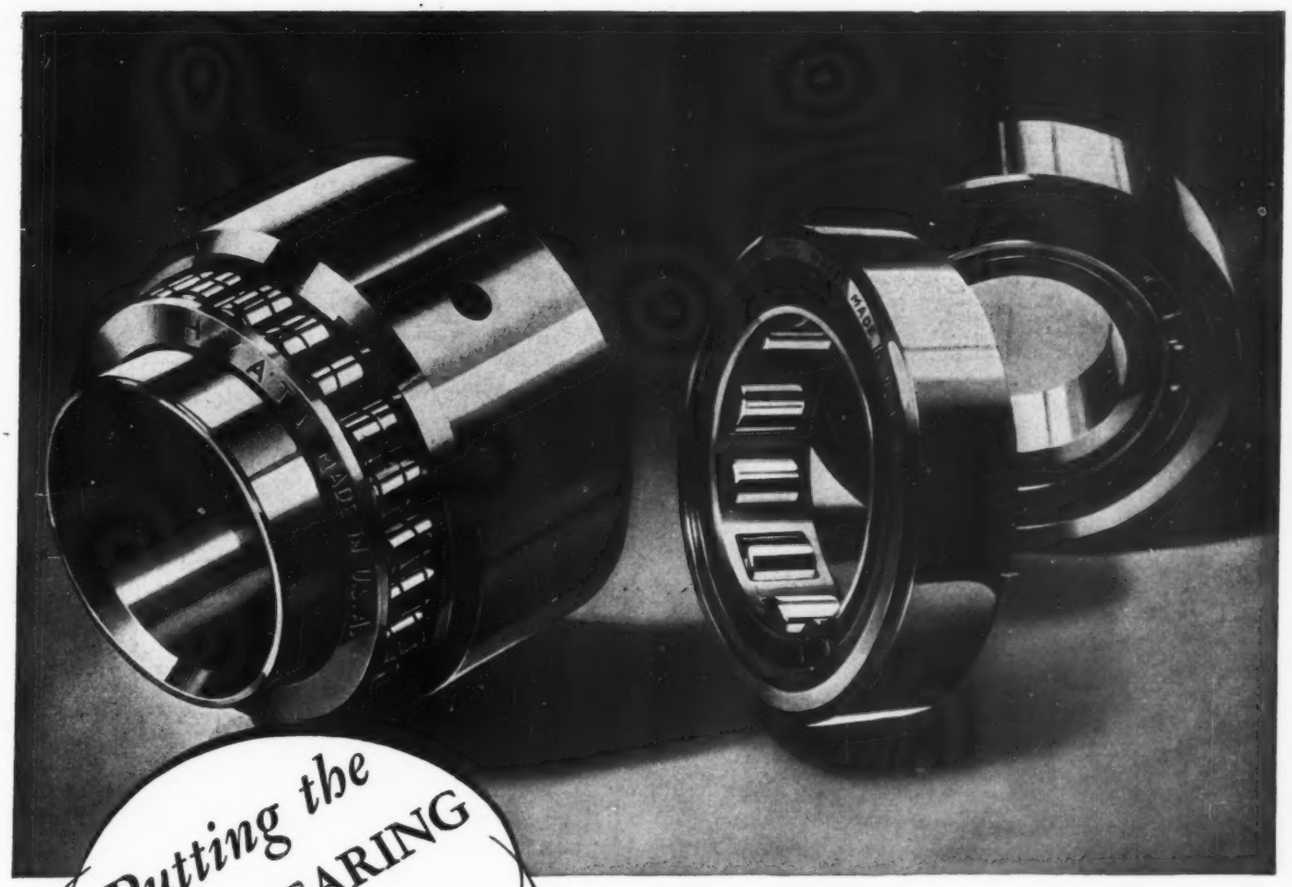
that saves money

No other manufacturer can offer you the years of experience in the building of magnetic equipment that is Dings'. Since 1899 Dings engineers have been solving separation, magnetic protection and power transmission problems, supplying the major needs where magnetic equipment is required.

This experience is your assurance of dependable advice, helpful cooperation and a proved product. There is no cost in taking advantage of it.

DINGS MAGNETIC SEPARATOR CO.
666 Smith Street, Milwaukee, Wisc.

Dings *High Intensity* **MAGNETIC CLUTCHES**



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Employed at strategic points Hyatt Roller Bearings keep things running smoothly. They are designed specifically to solve the problems of speed, load, wear and the steady grind of uninterrupted operation.

For over forty years these better bearings have made this important contribution to the building of better mechanical equipment. And this long and successful association with the country's principal industries has enabled us to accumulate authoritative knowledge of all forms of bearing requirements.

So closely have Hyatt engineers worked with and on all kinds of machinery development that many times their help has gone farther than bearing application design. That is how and why Hyatt Roller Bearings serve so extensively and so well. Hyatt Roller Bearing Company, Newark, Detroit, Chicago, Pittsburgh, Oakland.

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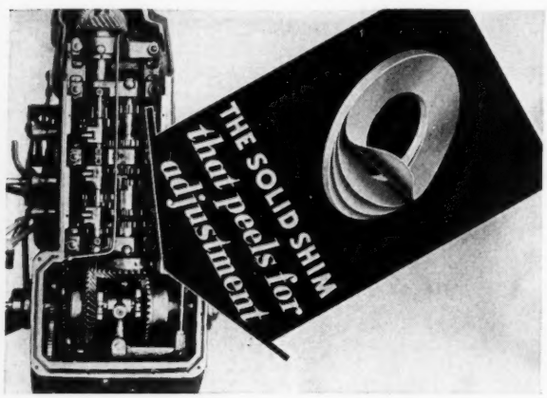


Production Drill, Barnes Drill Company.

• quick gear and bearing adjustment a feature of Barnes drills

By installing Laminum shims for quick service adjustment of gears and roller bearings, Barnes makes it easy for users to keep Barnes drills always in correct adjustment. Better work . . . longer equipment life . . . lower upkeep cost!

Quick adjustments of .002 or more at a time by simply peeling the laminated brass shim. No miking . . . no filing. As "solid" as solid shims . . . no "cushion"; no "squeeze". Always as smooth as glass and as hard as solid brass . . . no matter how many layers have been peeled off.

LAMINUM

LAMINATED SHIM COMPANY, INC.
2126 Forty-fourth Ave., Long Island City, N. Y.

529

ment is particularly desirable. By turning screw 9, *Fig.* 4, to spread apart the lower ends of the yokes, yoke 5 will turn about shaft 4 with relation to yoke 2 to draw their upper ends closer together against the effect of spring 8. This brings the teeth of upper gear 1 of each pair into more intimate engagement with the teeth of gears 11 and 12 to take out backlash between these gears and the gears of spider 3. Backlash of the lower pair of gears 1 will be increased, but this is immaterial because they are not in use at the same time.

If screw 9 is turned in the opposite direction

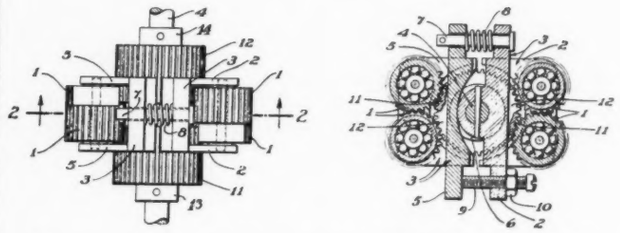


Fig. 4—Backlash is eliminated in differential gearing by an adjusting mechanism

the reverse operation will occur and backlash will be taken out of the lower gears 1 of the pairs. Gears 11 and 12 are mounted rotatively on shaft 4 on opposite sides of the spider of the differential and are held from displacement axially of shaft 4 by the spider and collars 13 and 14 which are pinned on to this shaft.

Ford Instrument Co. Inc., Long Island City, N. Y., is assignee of the patent which is designated No. 1,987,674.

Review of Noteworthy Patents

Other patents pertaining to design are described briefly as follows:

STRAND FEEDING MECHANISM—1,989,656—One of the objects of this invention is to provide an improved carrier, particularly a traveling carrier, adapted to feed a strand of yarn, wire, etc., to various types of machines such as braiders, winders, twisters, stranding machines and circular looms. Assigned to Textile Machine Works, Wyomissing, Pa.

FAN BLADE—1,985,705—The invention covered by this patent provides a form of blade in which concentration of particles is avoided and in which the tendency for the particles to be thrown out of suspension against the surface of the blade and central disk is lessened. Assigned to Prat-Daniel Corp., New York.

CAN FEEDING MECHANISM—1,985,897—A principal object of this invention is the provision of feeding mechanism for receiving cans in untimed relation, engaging them in succession and spacing them apart and accelerating them gradually for delivery at higher speed to the seaming mechanism. Assigned to American Can Co., New York.

HOW TO GET YOUR SHARE OF THE PROFITS OF PROGRESS

BECAUSE tradition pays no dividends many a machinery builder has turned to shield-arc welded steel construction for product improvement and more sales . . . the profits of progress. These profits are yours whenever and wherever you use this better method of machine construction.

Strength and rigidity are increased because shield-arc welding allows you to take full advantage of the superiorities of rolled steel. It is easier to use. Goes into production faster and allows quick changes in design at minimum cost.

But the necessary element is the *"Shield-Arc"* welder . . . guaranteed three ways to produce more welding per dollar. High K. W. capacity, uniform current and greater efficiency plus eight other features make the *"Shield-Arc"* a faster and more economical welder. And all these extra money-saving features do not cost you a penny more. Find out now how the *"Shield-Arc"* can give you a bigger share of the profits of progress. Write The Lincoln Electric Company, Cleveland, Ohio. Largest Manufacturers of Arc Welding Equipment in the World. W-113

LAD "We ought to watch the habits of our men and reprimand any one who smells of liquor."

POP "No, Lad, it's not the smelling of liquor that hurts a man . . . it's the drinking of it. It's not the *reading* of Shield-Arc Welding that pays dividends for us . . . it's the *using of it.*"

Automatic machines for weighing and recording batch mixing, built by Streeter-Amet Co., Chicago, Ill., are fabricated by the shield-arc process with "Fleetweld" electrodes.

LINCOLN

"SHIELD-ARC" WELDERS

DROP AND STEAM HAMMER
forgings..

No matter what your needs—hammer forgings to 15 tons, drop forgings to 700 pounds—Kropp forges to your specification. Shafts, bars, gear blanks, die blocks, rings, flanges, special part forgings—any analysis of steel—any heat treatment—one or a thousand—get them from Kropp. The most completely equipped shop in the middle west, plus the latest in modern forging facilities assures fast, economical production. Send blue prints and specifications for quotation.

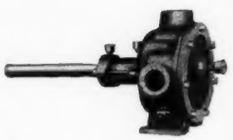
KROPP FORGE COMPANY
5309 W. Roosevelt Road,
Chicago, Illinois.

K

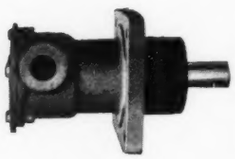
Viking Rotary Pumps "Just 2 Moving Parts"

ROTARY

Furnished in capacities from 5 to 1,050 G.P.M. Electric motor, belt or gas engine drive. Widely used in petroleum, textile, soap, milk, food processing and innumerable other industries. Just "two Moving Parts" . . . insures low power requirements and long life.



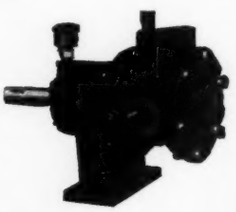
HYDRAULIC



Especially designed for the actuation of machine tool movements and the operation of hydraulic lifts and elevators and all other applications requiring a hydraulic oil pressure up to 500 pounds per square inch. Capacities of 5 to 45 G.P.M.

COOLANT

Made of the finest laboratory tested metals in capacities of 5, 10, 15, 20 and 35 G.P.M. Built-in relief rotor to act as relief valve when the oil line is shut off. Ports are tapped and plugged to permit changing the direction of rotation.



Write for FREE Folder and Prices

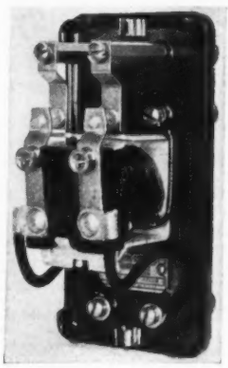
VIKING PUMP COMPANY
Cedar Falls, Iowa

"Gear within a Gear"

New Materials and Parts

Auxiliary Relays Are Introduced

DESIGNED for continuous duty at rated voltage, a small auxiliary relay for use on alternating or direct current and suitable for switchboard or panel mounting has been announced by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. The type SK auxiliary relay for switchboard mounting has a molded cover with or without glass front; the front connected



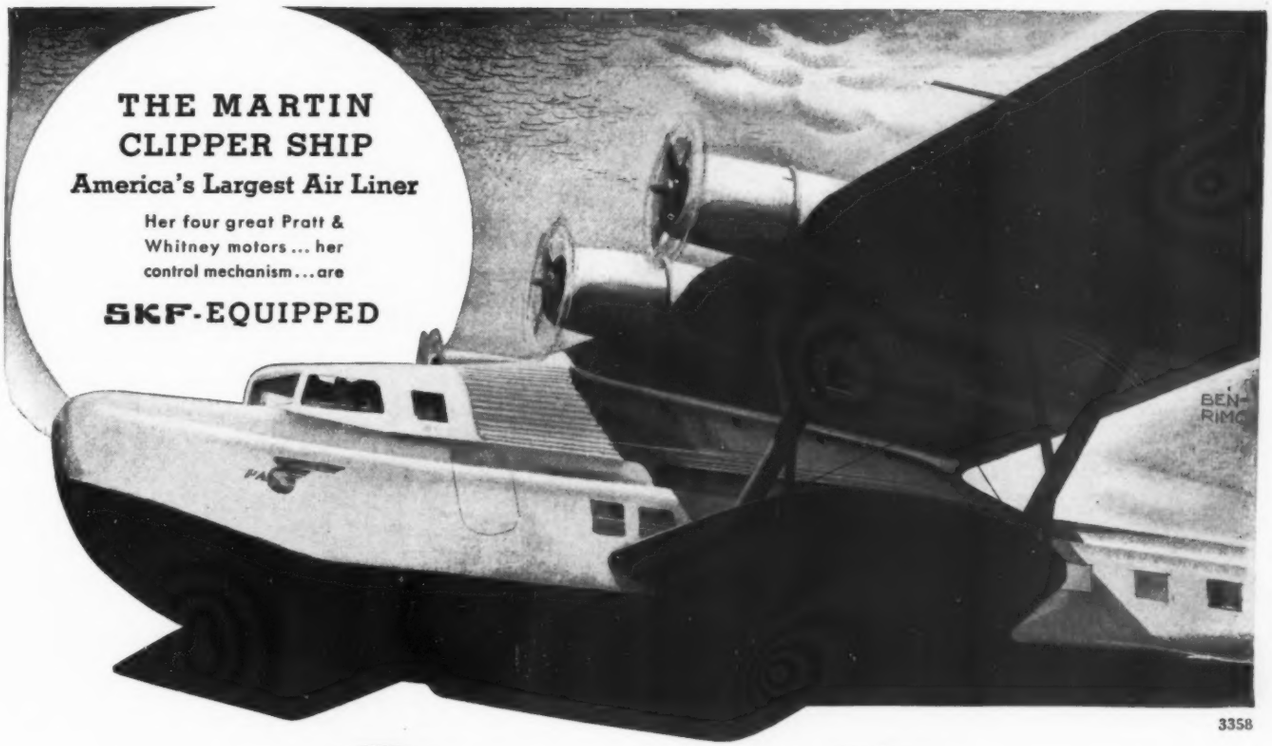
Auxiliary relays have two independent contact circuits which can be adjusted for circuit closing or opening

panel-mounted relay uses no cover. Both types have two independent contact circuits which may be adjusted for circuit-closing or circuit-opening service. For two independent opening circuits, additional material must be added to the standard relay.

The relay, shown herewith, is obtainable for circuits up to 550 volts alternating current or 440 direct current. Ranges up to 250 volts can be used for intermittent duty up to approximately three times their continuous value. The relay can be supplied with a coil for any current value up to 5 amperes. Each contact will carry 12 amperes continuous and 20 amperes for one minute.

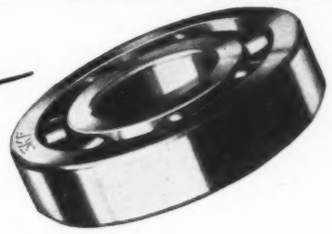
Announces New Line of Motors

AN ENTIRELY new line of convertible squirrel cage and slip ring induction motors, offering all standard frequencies for service ranging from 110 to 220 volts, has just been announced by Hart. chfeger Corp., West National avenue, Milwaukee. Built in accordance with the standard adopted by National Electrical Manufacturers association, the new motors are readily convertible from open type to fancooled, splash-proof or totally enclosed construction. This is accomplished through the design of the frame.



3358

AWARD *for* PERFORMANCE

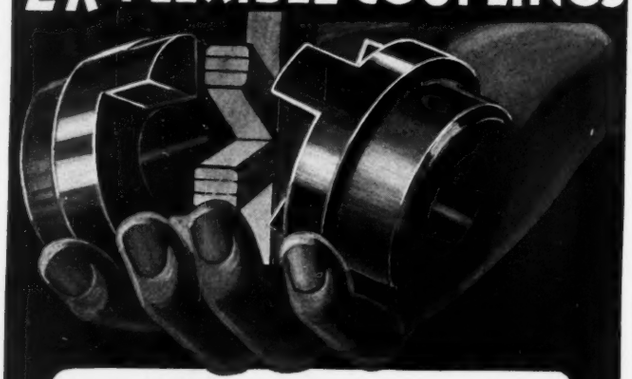


TRIED and true bearings, those that have been selected for the world's newest and greatest liner of the air. Tried on the Spirit of St. Louis . . . the Columbia . . . the America . . . the Question Mark . . . the Macon . . . the Graf Zeppelin. And so news that the great Martin Clipper Ship was to be SKF-equipped was welcomed not as just another order for bearings, but in view of SKF's record along the skyways, as another significant "Award for Performance". SKF Industries, Inc., Front Street and Erie Avenue, Philadelphia, Pa.

SKF

BALL AND ROLLER BEARINGS

L-R FLEXIBLE COUPLINGS



You SAVE when you use them

These efficient, three-piece construction, noiseless L-R FLEXIBLE COUPLINGS show savings that can be traced directly to their performance.

Designed for large misalignments, for easy and quick installation, they save in original cost, fitting and assembly. L-R FLEXIBLE COUPLINGS give trouble-free service for years—and can be instantly inspected at a glance without disturbing coupling flange or machine.

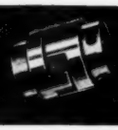
Manufactured and stocked in all sizes for shafts ¼" to 8", for loads up to 350 h.p. at 100 r.p.m.

SEND FOR COUPLING FOR TEST

Here is your opportunity to prove these statements yourself—in your shop—on your equipment. Tell us how you plan to use it, give shaft dia., h.p. and r.p.m. and we'll send stock coupling for test.

LOVEJOY TOOL WORKS

5018 West Lake Street Chicago, Ill.



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SPECIAL PUMPS

. . . You'll get the benefit of a pump specialist in solving pump problems—and we often save customers much expense by adapting stock parts.

B·S

Tell us your problem!

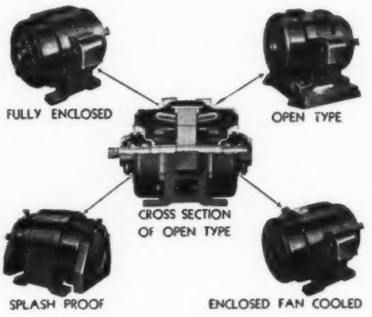
Brown & Sharpe Mfg. Co.

Providence, R. I.

Brown & Sharpe Pumps

Geared — Vane — Centrifugal

end heads and bearings to permit interchangeability in the four types of single or multispeed squirrel cage and slip ring motors. Stator laminations are stacked between heavy steel end rings and the entire assembly then welded to the frame. Rotor windings are assembled from round or rectangular hard drawn copper bars which are placed in the rotor slots without insulation or slot wedges. The ends of the bars are brazed to the end rings by an electric arc torch.

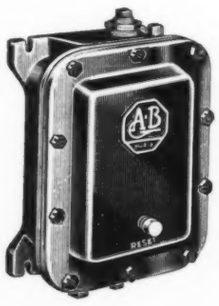


Interchangeability is permitted in motors by design of frame, end heads and bearings

Switches Protect Against Explosion

TYPE G explosion-proof enclosures, heretofore supplied only for size 1 bulletin 709 solenoid-operated across-the-line switches, are now being built by Allen-Bradley Co., 1311 South First street, Milwaukee, for the sizes 2 and 3 switches for polyphase motors up to 15 horsepower, 110 volts; 30 horsepower, 220 volts; and 50 horsepower, 440-550 volts, and for self-starting single-phase motors.

The type G enclosure fully meets the requirements of the Underwriters' Laboratories for class 1, group D hazardous gas locations, such as dry cleaning establishments, gasoline filling stations, or wherever inflammable gases or vapors may be present. The enclosure is of cast iron, black enameled with a white enameled interior finish, which makes all terminals, switch parts, and overload relays stand out plainly.



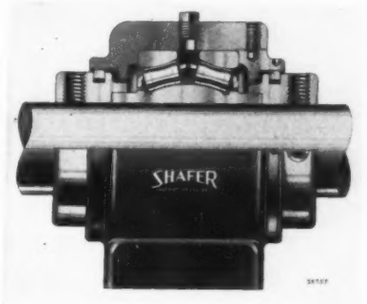
Enclosures for switches to be used in hazardous gas locations are explosion proof

The heated gases, created by any accidental

internal explosion, are cooled before reaching the atmosphere by the dissipation of their heat in passing between the wide-flange, machined surfaces between cover and base of the cabinet.

Bearings Include Piston Ring Seal

A NEW piston ring seal and square collar design have been added to the line of standard duty pillow blocks and self-aligning roller bearings being manufactured by Shafer Bearing Corp., 6563 West Grand avenue, Chicago. The inner bearing race, shown herewith, is not notched but has four flats on the outer diameter which



Self-aligning bearings incorporate piston ring seal and square collar design

are engaged on each side by corresponding flats on the inner diameter on two locking collars used. Each collar has two set screws and carries a piston ring which provides an effective seal, adequate for all dirt, dust and water conditions excepting the most extreme.

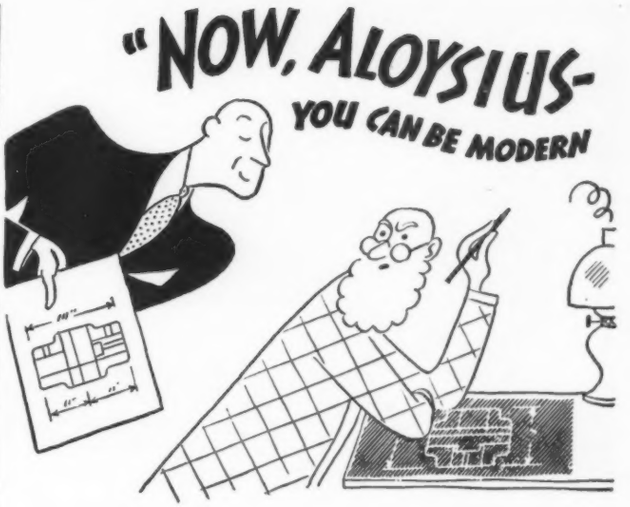
The piston ring seal in standard duty roller bearings is furnished only on units which contain double row radial-thrust roller bearings. These bearings are inherently self aligning, so provision for misalignment need not be made in the housing.

Circuit Breakers Are Redesigned

OIL-BLAST breakers in a new design for panel mounting, designated as type FK-43, have been announced by General Electric Co., Schenectady, N. Y. All three poles of the new breaker are enclosed in one frame and tank; both frame and tank are completely fabricated from steel plate with all joints welded. The breaker mechanism is of the internal type.

New Timer Controls Operations

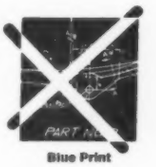
FOR USE in connection with a wide variety of electrically operated devices and machines requiring automatic timing of the "power-on" and "power-off" periods, Electric Controller &



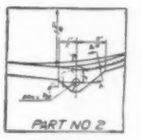
—We've changed to BLACK AND WHITE Prints!"

Blue prints were invented in 1840—away back in covered wagon days. Since then, four generations of users have strained their eyes trying to read them ...and have cracked their tempers trying to decipher pen or pencil notes on dark blue backgrounds.

But today, you can make BLACK AND WHITE PRINTS—clean, clear black lines on white backgrounds—even FASTER than blue prints! BW Prints require no negative, no washing or drying. Users say that their overall cost is *even less* than that of blue prints. Anybody who now has a blue print machine can enjoy BW advantages.



Blue Print



BW Print

BW Prints — easier to make than blue prints — far easier to read and check

Find out why BW Prints are used by thousands of firms throughout the country! Mail the coupon—now—for our free book, "Black and White Magic."

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Gentlemen: Please send me, without obligation, your FREE book, "Black and White Magic."

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When You Require
Coolant Pumps . . . .

Specify —

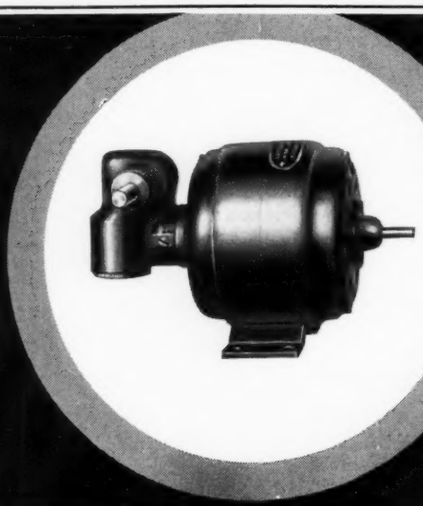
"BROWNIE"

Closed Type

A pump which has no packings to leak. No screens to clog. A pump which is entirely self-aligning. "Open" types (for setting on bottom of tank) and "Closed" types (for mounting on outside of tank) 10-100 G.P.M. A pump which handles anything from coolant, impregnated with grit and chips, to oil.

Write for Bulletin No. 10

The TOMKINS-JOHNSON Co.
618 N. MECHANIC ST.
JACKSON, MICHIGAN

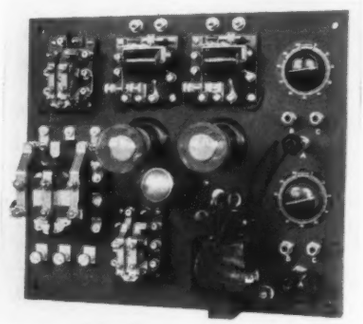


INDUCTION SHADED POLE
FRACTIONAL H. P. MOTORS
Signal Induction Shaded Pole Fractional H.P. Motors range in size from 1/1000 to 1/12 H.P. with gear reduction available for many types. Also Universal Motors from 1/500 to 1/10 H.P. Let us know your requirements.
SIGNAL ELECTRIC MFG. CO.
Menominee, Michigan

OFFICES IN PRINCIPAL CITIES

MANUFACTURERS OF ELECTRICAL PRODUCTS
SIGNAL

Mfg. Co., Cleveland, has developed an automatic repeat process timer. Operating on the principle of the time required to charge a condenser, the timer, shown herewith, provides a quick, convenient means for closing an electrical circuit for a definite length of time, and then opening the circuit for a similar, or different time as desired, and repeating this cycle of operation as long as the control push button or master is closed. Both the on and off periods are independently adjustable.



Timer provides a quick, convenient means for closing an electrical circuit for a definite length of time

The timer is built in four standard sizes and is designed for operation on 110, 220, 440 or 550 volt circuits of any standard frequency.

Watertight Enclosures Announced

TYPE B enclosures of watertight, weatherproof construction have been developed by the Allen-Bradley Co., 1311 South First street, Milwaukee, for its line of Bulletin 709 solenoid-operated across-the-line switches having polyphase ratings up to 15 horsepower, 110 volts; 30 horsepower, 220 volts; and 50 horsepower, 440-550 volts; and for single-phase motors of the self-starting type. These type B bulletin 709 switches are suitable for outdoor installations and for use in laundries, tanneries, pumping stations, or wherever the air is heavily charged with moisture.

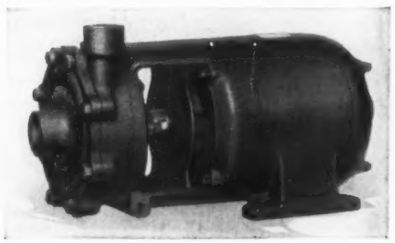
Cast iron, cadmium plated to resist corrosion, is employed for case of watertight enclosures

The type B enclosure is of cast iron, cadmium plated to resist corrosion. A live rubber gasket between the cover and base keeps out all mois-

ture. The top and bottom of the base are tapped for threading in conduit, thus making it possible to obtain a watertight seal between the conduit and box.

Centrifugal Pumps Are Improved

ESPECIALLY applicable to all services which might require small capacity and medium discharge head, an advanced development of the two-stage Monobloc centrifugal pump has been introduced by Worthington Pump & Machinery Corp., Harrison, N. J. Casing of the pump, shown herewith, is bolted directly to the motor frame without any intermediate distance piece, thus eliminating the necessity for a baseplate.



Casing of the pump is bolted directly to the motor frame without any intermediate distance piece

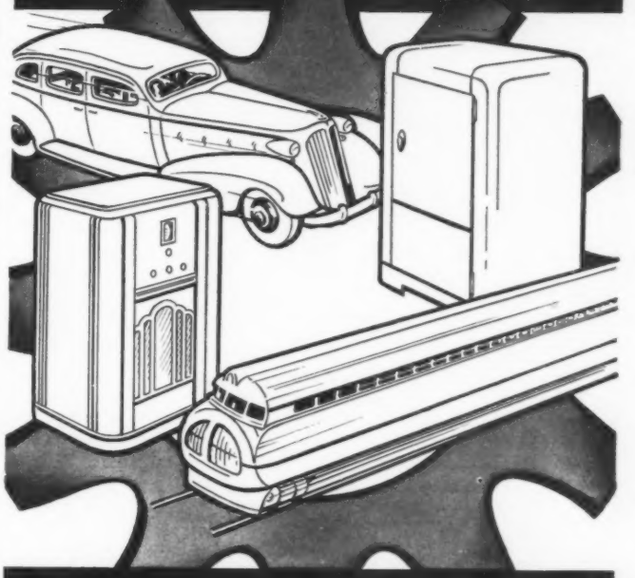
The impeller is a unit construction consisting of two enclosed type impellers cast back-to-back so that the overhung weight is no greater than that on a single stage pump. An impeller nut holds the impeller, which is keyed, firmly to the shaft; the shaft sleeve, also keyed, is a separate part. In this unit as the impeller is mounted directly on the motor shaft the additional space and weight of a coupling is eliminated. The pump can be mounted vertically or horizontally.

Introduces New Small Motors

FRACTIONAL horsepower, split phase, heavy duty motors are now being offered by Kingston-Conley Electric Co., 66 York street, Jersey City, N. J. All of the parts in the motors, shown herewith, are cadmium plated. There is no possibility of sticking, sparking or fluttering of the contacts. A centrifugal starting switch is supplied with the motors. This switch is made with

Centrifugal starting switch is supplied with fractional horsepower motors

SHAKEPROOF



MEETS THE PERFORMANCE STANDARDS OF 1935!

NEW CATALOG

Just off the press—our new 1935 catalog tells you how to solve your locking problems. Also illustrates and explains other patented Shakeproof products—a truly valuable book—send for your free copy today!

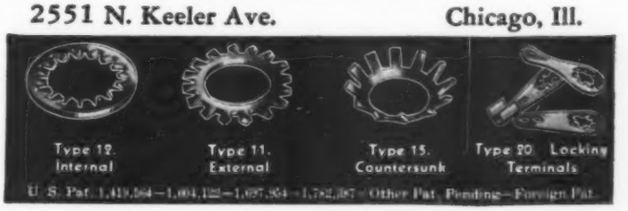
IN every industry, engineers are striving to achieve new performance peaks. Faster speeds—greater efficiency—longer life, are some of the goals that they are trying to reach. That's why the demand for Shakeproof Lock Washers is constantly growing—the need for a tight, vibration-proof locking method is paramount. Be sure to try Shakeproof Lock Washers on your product—see how each twisted tooth forms a positive double-action lock that only applied pressure can release. Then realize that the power of this lock is multiplied by the number of teeth on the washer (from 6 to 20 times)—that's why you can depend on Shakeproof to hold each and every screw or nut absolutely tight! Send for testing samples today!

"It's the twisted teeth that lock"

SHAKEPROOF
Lock Washer Company

Distributors of Shakeproof Products
Manufactured by Illinois Tool Works

2551 N. Keeler Ave. Chicago, Ill.



U. S. Pat. 1,419,564—1,604,122—1,697,564—1,762,887—Other Pat. Pending—Foreign Pat.

PATENTED

Gits Precision Oil Seal

Construction Exclusive Feature

Note the improved form of flexible leather washer which prevents the leakage of oil from the housing.

The leather washer is tapered where the pressure of the flat spring clamping ring is applied.

The flexibility of the tapered leather requires but a slight pressure to be contracted and effectively seal with minimum friction on shaft.

The sharp edge of the tapered washer shears the oil film preventing escape of oil.

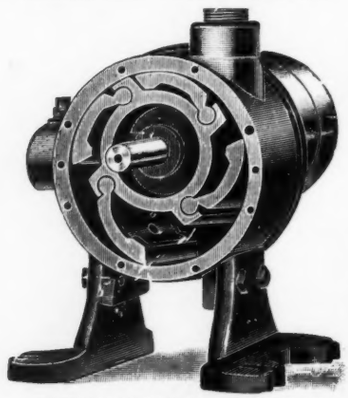
Send for Catalogue

GITS BROS. MFG. CO.

1861 S. Kilbourn Avenue - - Chicago, Ill.

This Air Pump Does The Work—

Vacuum or Pressure in the hands of the Novice as well as the Expert



LEIMAN BROS. Patented

AIR PUMPS

Rotary Positive

Last a Lifetime

Read this!

"We take pleasure in advising you that we are using your air pumps on 350 of our machines, and in no instance has this pump given a moment's trouble, in spite of the fact that in most cases our machines are installed in factories where the employees are not familiar with machinery and in consequence they are not given the proper care."

LEIMAN BROS., INC.

23 X Walker St., New York - 165 Christie St., Newark, N. J.

Makers of Good Machinery for 45 Years

silver contact points and torsion-spring tension. Felt disk packing, between steel washers on both sides of the ball bearings, provide effective sealing for the bearings. The ventilation system carries air directly across the windings from one end to the other. Crinkle finish is used for the frame.

The new motors are available at 60 cycles, 110 or 220 volts, 1740 revolutions per minute and can be supplied in 1/6, ¼ and 1/3 horsepower, split phase or three phase.

Announces Indicating Controllers

SENSITIVITY and quick action is available with the indicating potentiometer controller now being built by C. J. Tagliabue Mfg. Co., Park and Nostrand avenues, Brooklyn, N. Y. Besides the potentiometer circuit there is nothing in the controller, shown herewith, but the photocell circuit with its relay. Photoelectric detection of a narrow light beam is reflected from a mirror galvanometer. To decrease wear on relays the sensitivity can be adjusted low enough to permit a one or two degree differential.

Power is shut off in this controller if the lamp which operates it burns out

A safety feature of this photoelectric controller is that when the lamp burns out power is shut off. Another safety arrangement is obtained by offsetting the galvanometer zero slightly so that if the thermocouple circuit breaks the power shuts off. This offset is not necessarily large and does not introduce any error in standardizing or controlling.

Hose Employs Two Strength Members

POSSESSING the advantages of both wrapped duck and braided hose, the new air hose announced by Manhattan Rubber Manufacturing division of Raybestos-Manhattan Inc., Passaic,

N. J., is constructed of two strength members, a braided cord member for longitudinal stresses and a spiralled strength member for expansion and lateral stresses, both welded in rubber. By this balanced construction, internal friction and chafing are overcome.

Clutch Gives Sensitive Control

PARTICULAR attention has been given to provide the operator a sensitive control requiring minimum pressure on the treadle in the design of the new electric clutch for individual sewing machine drives developed by American Safety Table Co., Reading, Pa. This unit, shown herewith, is an improvement of the tapered clutch and brake used in the group drive table also manufactured by the company. The entire unit is compact, and all working parts are housed and shielded against dirt and contact with the operator's clothing.

Working parts of electric clutch are shielded against dirt and from contact with the operator

Improved Steam Turbine Announced

FOR USE in connection with generators or pumps, California Bettis Co., 1900 East Sixty-fifth street, Los Angeles, has developed a new type of steam turbine which provides a power unit for services requiring up to 3½ horsepower. The turbine, shown herewith, is equipped with a newly designed governor which

Governor in improved steam turbine does not come into direct contact with the steam

But—

a *standard* BODINE motor solved the problem . . .

Business machines present many special motor problems, and this calculator was no exception. It required built-in compactness—high starting torque—accurate speed control—A. C. and D. C. operation. During an average year's service, it must start and stop four million times!

Despite these special requirements, the regular BODINE line contained a *standard* motor for the job—a low-priced machine of proven performance that could be produced in quantities without delay.

BODINE has a standard motor for *your* special machine

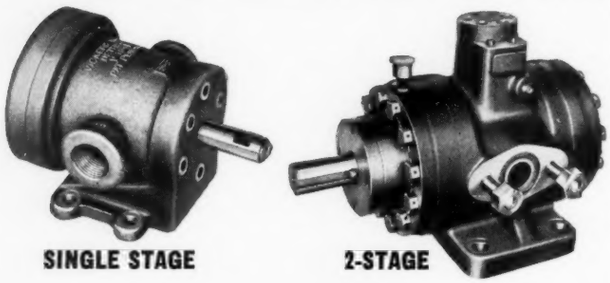
The standard BODINE line includes hundreds of fractional horsepower motors for unusual and difficult applications. It includes both A. C. and D. C. motors from 1/1300 to 1/4 H. P., for constant or multiple speeds for every load condition.

Whatever your electric drive problem may be, there is a BODINE motor for the job. Write for complete information and descriptive literature.

BODINE

BODINE ELECTRIC CO.
2258 W. Ohio Street
Chicago, Ill.

FOR BETTER HYDRAULIC (OIL) FEEDS AND CONTROLS



SINGLE STAGE 2-STAGE

VICKERS

VANE-TYPE ROTARY PUMPS

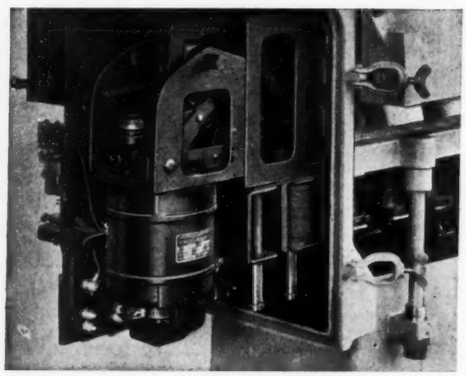
HYDRAULIC balancing principle eliminates side thrust loads and the wear that would result. Shaft and rotor are carried on ball bearings. Volumetric efficiency and overall mechanical efficiency are unusually high.

Single stage pump has working pressures to 1000 lb. per sq. in. and is made in 7 sizes having capacities from 2 to 38 gal. per min. Two stage pump has working pressures to 2000 lb. per sq. in. and is made in 4 sizes having capacities from 2 to 18 gal. per min. Either foot or flange mounting provided. Write for Bulletins 34-2 and 34-5.

VICKERS INCORPORATED

1430 OAKMAN BLVD. DETROIT, MICHIGAN

MOTORS BUILT TO FIT THE JOB



Outdoor rapid reclosing circuit breaker made fully automatic with special Holtzer-Cabot high torque motor drive.

These units frequently located on the outlying extensions of power lines many miles distant from supervision or inspection—must operate unfailingly. In addition, these motors must meet exacting mechanical and electrical requirements heretofore unequaled and unexpected.

Holtzer-Cabot Motors were chosen by the manufacturer of these units because of their absolute dependability.

Our engineers will gladly confer with you. Their experience can be helpful—write Dept. 14 for descriptive bulletin.

THE HOLTZER-CABOT ELECTRIC COMPANY

125 Amory St., Boston, Mass.

MOTOR SPECIALISTS FOR 50 YEARS

does not come in direct contact with the steam. All bearings are designed for high speed operation. The one-piece rotor was developed to withstand all abuses to which it might be subjected, such as wet steam, variable pressures and lack of regular attention.

Introduces Improved Oil Burner

EFFICIENT combustion over a wide range of capacities and with various grades of fuel is provided by the new low pressure oil burner of Philadelphia Drying Machinery Co., 3351 Stokley street, Philadelphia. Oil enters the unit, shown herewith, through a small supply

Low pressure oil burner provides efficient combustion over a wide range of capacities

line at the back, passes through a central oil tube to a distributor inside the burner housing, where it is directed into an oil chamber surrounding the primary air orifice. Air enters through a butterfly valve in the center lower portion of the burner housing whence part of it enters the distributor head and passes through the primary orifice and then through a venturi. This creates a partial vacuum in the oil chamber so that oil is withdrawn in a thin film around the air. This film is broken into a fine mist and is intimately mixed with the primary air as it passes through the venturi. The secondary stream of air flows between the burner body and the outside of the venturi mixer. It is given a whirling action and is then discharged through the orifice near the nose of the burner.

Deposit Resists Impact and Abrasion

A NEW hard surfacing electrode which is designed for application to carbon steel, low alloy or high manganese steel surfaces to enable such surfaces to resist abrasion has been developed by Lincoln Electric Co., Cleveland. This new electrode, known as "Abrasoweld," provides a deposit of abrasion resisting alloy of the self-hardening type, which surface hardens rapidly under conditions of impact and abrasion. The deposit develops its maximum hardness only at the surface where it is cold worked.

Trademarks Increase Buyers' Confidence

(*Concluded from Page* 33)

"Portage," for example, may be registered by one person for fire extinguishers and also by another person for machine tools, each being in separate subclasses, but under the same broad classification; namely, "Class 23, Cutlery, Machinery, and Tools and Parts Thereof."

The fifty classes of merchandise are listed on the last page of the Trademark pamphlet issued by the Patent Office, and the owner of the mark may determine into what class his goods fall by referring to the list. Sometimes in registering a trademark, the Patent Office may decide that the applicant has selected the wrong class. For instance, when the applicant selected, "Class 2, Receptacles," in registering the word "Kleen-Way," *Fig.* 1, the Patent Office decided that the fluid drainer and pump belonged in Class 23; namely, "Cutlery, Machinery, and Tools and Parts Thereof." In naming the specific goods under a certain class, it is a good policy to name the specific goods as broad as possible. The Patent Office tries to restrict the description to a narrow field. With reference to *Fig.* 7, note the specific naming of the goods. If a trademark is used upon goods in more than one class, a separate registration must be filed for each class to cover the goods within that class.

When the patent office allows a trademark under the 1905 Act, the mark is published for a period of thirty days in the *Patent Office Gazette,* a weekly publication. *Fig.* 4 illustrates the manner in which the marks appear. Within this period of thirty days, any person who believes that he would be damaged by the registration of the mark may file a complaint in the patent office, setting forth the reasons why the mark should not be registered. The Patent Office then declares what is normally called an Opposition proceeding, which is in the nature of a law suit before the Patent Office. Each of the parties is entitled to take testimony to prove the merits of his own position.

In an Opposition proceeding the person who files the complaint has the burden of proof, and frequently this works to his disadvantage because the Patent Office is inclined to favor the applicant. It is the policy of some manufacturing concerns not to file a complaint in the Patent Office, but instead to notify the applicant who is just entering the field of infringement of their trademark and bring a suit in the Federal courts against the applicant. By selecting a suit in Federal court, there is a tendency for the court to uphold a well-established trademark as against one entering the field, and as a result the burden falls upon the applicant.

Illustrations used for *Figs.* 1 and 2 are by courtesy of Johnson Motor Co., and Addressograph-Multigraph Corp.

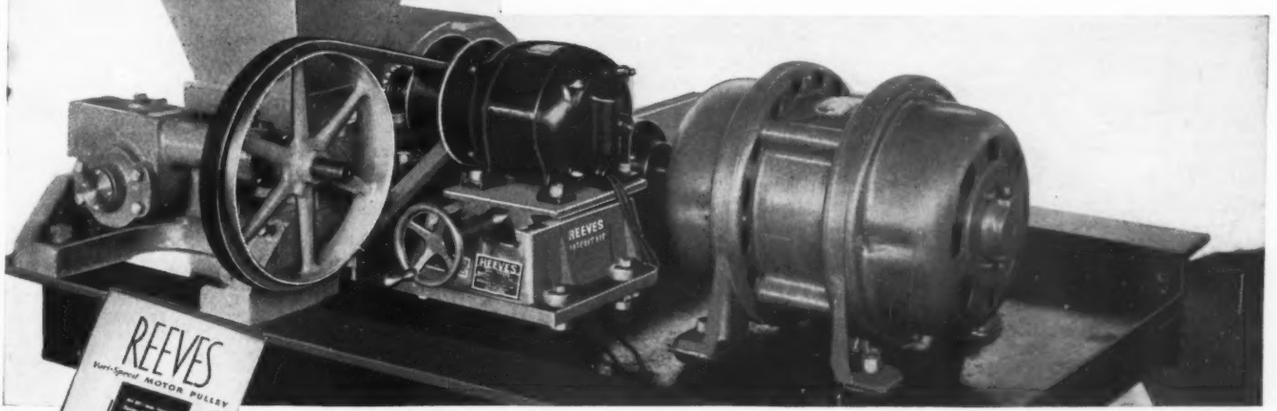
★ REEVES ★
VARI-SPEED
MOTOR PULLEY

THE REEVES Vari-Speed Motor Pulley is an efficient, compact variable speed unit, *applicable directly to the standard shaft extension* of any constant speed motor.

This simple, sturdy unit—built by the makers of the REEVES Variable Speed Transmission—provides *complete speed adjustability* over a 3:1 ratio, for power requirements from fractional to 7½ H. P. *Any* speed desired is obtained instantly and accurately merely by turning a convenient speed control handwheel.

Made in seven sizes. Low in cost; quickly installed. Used as standard equipment by many leading manufacturers of industrial machines.

• *Illustration shows* REEVES *Vari-Speed Motor Pulley driving feed screw of Pulverizing Machine, on which it is standard equipment. Speeds are quickly and accurately varied to compensate for changes in atmosphere and temperature—and for differences in type and consistency of materials being ground.*



REEVES PULLEY CO., Columbus, Ind.
Without obligation, send copy of catalog H-200 which gives complete information on the REEVES Vari-Speed Motor Pulley and illustrates specific machine applications. 3-35

Name.....
Company.....
Address.....

ALLOYS (STEEL)—The latest authentic data on the various members of the Enduro 18-8 family of stainless steels is included in a new booklet prepared by Republic Steel Corp., Massillon, O. Included in the booklet is a table showing the degree of corrosion resistance exerted by three types of the steel in the presence of several hundred individual chemicals, solutions and other reagents.

ALLOYS (STEEL)—American Rolling Mill Co., Middletown, O., has prepared a folder on its Armco 18-8 and 17 stainless steel alloys, entitled "Fine Finishes Make Fine Products," which gives the properties of the metals.

CONTROLS (ELECTRICAL)—Ward Leonard Electric Co., Mount Vernon, N. Y., is distributing catalog inserts on alternating current magnetic contactors, two, three and four-pole; direct current magnetic contactors, one and two-pole; and plaque resistors, noninductive and noncapacitive.

COUNTING DEVICES—How these units can be used to increase the utility of a machine, and a complete description of the units in the line are presented in an attractive booklet of Veeder-Root Inc., Hartford, Conn. The publication includes a discussion of counters especially designed for unique applications.

DESIGN DEPARTMENT—Hamilton Mfg. Co., Two Rivers, Wis., has published a supplement to its catalog No. 10 which describes seven new developments in engineering department equipment. The developments cover a new approach to several drafting room problems and include tracing lifters, plan folders, chairs, lights, drawing tables, reference tables and engineering desks.

DRIVES—Standard types of detachable, pintle, ley bushed, combination, drag, roller, transfer, steel bushed and drop forged chain and chain attachments are presented in bulletin No. 74 of C. O. Bartlett & Snow Co., Cleveland. The bulletin also includes information on sprockets, shafting, collars, spur, miter, girt and bevel gears and other parts.

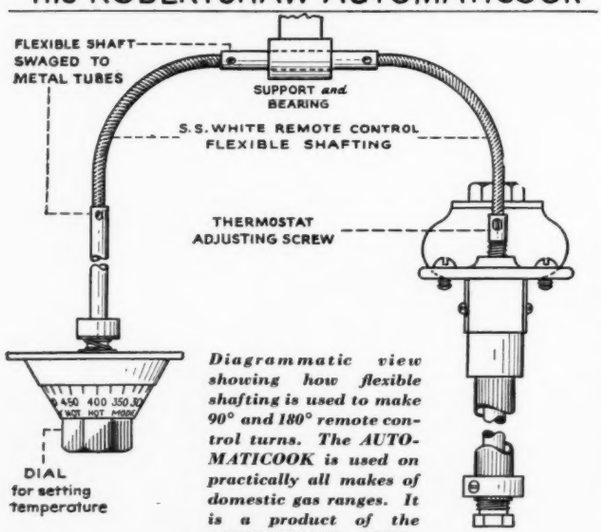
FASTENINGS—A source reference for the selection of assembly parts and special units which can be specified in the design of new machines is provided by the new handbook entitled "Special Washers and Stampings," published by Wrought Washer Mfg. Co., Milwaukee.

FASTENINGS—Barber-Colman Co., Rockford, Ill., has prepared a bulletin on their method for fastening various units on a revolving shaft. The method consists of cutting a taper spline on the end of the shaft and a straight spline in the taper bore of the unit to be attached. Easier assembly, more secure locking and greater strength are provided, by this system.

FINISHES—Heat-hardenable varnish, enamels and lacquers, and heat-hardenable and self-hardening cements are discussed in an attractive new booklet of Bakelite Corp., Bound Brook, N. J. Properties, uses and methods of applica-

The FLEXIBLE SHAFT solves another REMOTE CONTROL problem

The ROBERTSHAW AUTOMATICOOK



Diagrammatic view showing how flexible shafting is used to make 90° and 180° remote control turns. The AUTOMATICOOK is used on practically all makes of domestic gas ranges. It is a product of the ROBERTSHAW THERMOSTAT CO. of Youngwood, Pa.

The ROBERTSHAW gas oven temperature control furnishes an example of the use of flexible shafting in solving remote control problems where turns are involved. In applying the control to different ranges, the relative positions of operating dial and thermostat adjusting screw, make necessary 90° and 180° turns. The illustration shows how these turns are made.

S. S. WHITE Remote Control Flexible Shafting is used. This shafting was developed to meet remote control requirements. It differs from conventional flexible shafting in that it has very little torsional deflection under load, and deflection is equal for either direction of rotation.

IF YOU HAVE A REMOTE CONTROL PROBLEM

let our engineers help you work it out. Send us details of the problem and we'll give you our recommendations—without obligation.

The **S. S. WHITE** Dental Mfg. Co.
INDUSTRIAL DIVISION
152-66 West 42nd St. NEW YORK, N. Y.

tion are included for each of the products.

GEARS—"Gear Craftsmanship" is the title of a new booklet prepared by Meisel Press Mfg. Co., Boston, which gives technical data and diagrams on the shape of gear teeth and other information of importance to the designer specifying gears.

MOTORS—Three attractive new bulletins prepared by Louis Allis Co., Milwaukee, include engineering and other pertinent data on direct current motors, totally-enclosed fan-cooled motors and single phase capacitor motors. Parts of the motors are pictured in detail.

MOTORS—Details of construction and operation of the new convertible P&H motors ranging from ½ horsepower, 600 revolutions per minute to 125 horsepower, 3600 revolutions per minute are presented in bulletin HM-1 of Harnischfeger Corp., Milwaukee.

PACKING GLANDS AND PACKING—Victor Mfg. & Gasket Co., Chicago, is distributing a folder on its line of packings including grease retainers and oil seals, sheet rubber, compressed asbestos sheet, cork sheet and rod packings.

SHAFTING—Bliss & Laughlin Inc., Harvey, Ill., has prepared a folder on its line of steel shafting and small rounds The shafting, available in a wide range of sizes and finishes, is manufactured in standard and special analyses, including the carbon steels and alloy grades.

SHAPES—Union Drawn Steel Co., Massillon, O., is distributing a bulletin which presents the improvement in steel properties afforded by the cold drawn process.

VALVES—Three and four-way hydraulic operating valves and the company's complete line of valves are presented in reference book No. 37 of Homestead Valve Mfg. Co., Coraopolis, Pa. The booklet includes photographs of applications and suggested uses of the valves classified by industries.

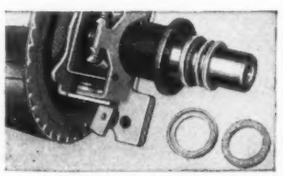
Research Publications

Unbalance in Alternating-Current Rotating Machines, by E. M. Sabbagh. With the impedence of a machine considered to be real constants, general equations have been developed for the steady state currents in a wye connected alternator supplying power to unbalanced loads. These were then applied to the cases of short circuits investigated by several other engineers, and it was found under the assumption that the results agree. With regard to the induction motor, it has been found that, under certain conditions, the introduction of the induction motor not only helps to balance the line currents but also permits the alternator to carry a larger single phase load between the same terminals. Furthermore, the magnitude of the currents drawn by the induction motor were computed and its capacity calculated. The author has given the specifications of the induction meters, or other machines, to be introduced into the system whereby it is possible almost to double the single phase load which could be carried by the alternator feeding that system. Published as Research Bulletin No. 45 by Engineering Experiment Station, Purdue university, Lafayette, Ind., 96 pp.

Wagner Motors are Quiet

Stokers, Oil Burners, Blowers, Fans, Refrigerators, Air-Conditioning Systems and other similar types of electrically driven equipment are kinds of apparatus where *quietness* is an essential factor for satisfactory performance. It was inevitable that quiet operation would be demanded, and it IS expected today.

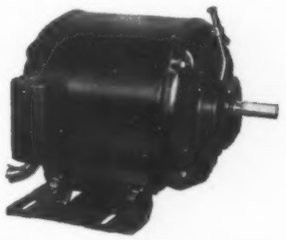
That progressive manufacturers have anticipated this demand is reflected in the increasing use of Wagner resilient-mounted motors. Wagner motors are the product of 44 years of experience in motor building and some 20 years of close co-operation with the manufacturers of electric refrigerators, an industry where noise was an obstacle that Wagner successfully overcame.



Among the distinctive features contributing to the quietness of Wagner motors is the rubber mounting, made up of layers of rubber and steel vulcanized together—elastic enough to absorb the small amount of vibration remaining even in the most carefully-designed motor, yet firm enough to preserve correct shaft alignment. The upper photo illustrates this type of mounting, a mounting that does not interfere with the removal of the motor or its endplates.

Another feature is the cork thrust-washer (see lower photo) which eliminates end-play noise. In addition, rotors are skewed to reduce magnetic noise, and dynamically balanced to eliminate vibration; and governor weights are silenced with felt bumpers.

Quiet operation is but one of several motor qualities manufacturers of motor-driven machines must consider. There are also such considerations as dependability, interchangeability, appearance, and performance—all of which are fully provided for in Wagner design and construction. For a full description of Wagner motors, ask for Bulletin 167.



There's a Wagner motor to fit your needs, regardless of the type you prefer. Included in the Wagner line of motors are

Type RB	Split Phase
Type KA	Repulsion-Start-Induction
Type RBZ	Capacitor-Start Induction-Run
Type RZH	Capacitor-Start Capacitor-Run
Type RD	Direct-Current
Type RP	Polyphase Squirrel-Cage

Wagner Motors are available in such various mechanical variations as open, totally-enclosed, or drip-proof; rigid or resilient mounted; horizontal, vertical, or flange-mounted; sleeve or ball bearing, etc.

MOTORS
TRANS-FORMERS

Wagner Electric Corporation
6400 Plymouth Avenue, Saint Louis, U.S.A.

FANS
BRAKES

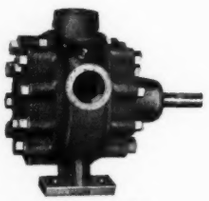
S635-2D

PUMPS FOR ALL PURPOSES

HYDRAULIC POWER

If it's hydraulic power you need for rapid traverse or tool feeds on machine tools . . . press work . . . sidewalk elevators . . . portable truck lifts . . . or a dozen other needs . . . the answer is a Roper Rotary Pressure Pump.

We have been at this business for 78 years . . . and we know how to build pumps that do a two-fisted job.

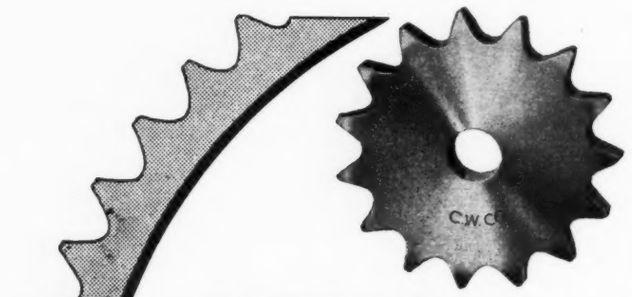


Write for Bulletin No. R-5-MD

"Dependable Pumps Since 1857"

GEO. D. ROPER CORP., ROCKFORD, ILL.

THE HEART OF POWER ROPER PUMPS



CULLMAN IS A SPROCKET SPECIALIST

- The Cullman plant has special tools and machinery for producing sprockets in large quantities.
- Consequently we can furnish sprockets at less cost and better quality than the average manufacturing plant.
- Cullman sprockets have been used for years by many leading concerns because of their accuracy and dependability.

Send for the Cullman sprocket book.

CULLMAN WHEEL COMPANY
1356 Altgeld St., Chicago, Ill.

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• • •

MACHINE DESIGN is a monthly technical publication conceived, edited and directed expressly for those executives and engineers responsible for the creation and improvement of machines built for sale, and for the selection of the materials and parts to be used.

Business and Sales Briefs

JOHN A. ROBINSON, formerly in charge of the Dallas, Tex., office of Timken Roller Bearing Co., Canton, O., has been transferred to the automotive division and appointed manager of that division with headquarters at the Chicago office. H. W. Trump has been appointed to the position of district manager of the industrial division at Dallas.

* * *

SKF Industries Inc. has opened a new branch store at 407 South Fourth street, Minneapolis. A. Kishkunas is in charge. The new office carries a complete stock of ball and roller bearings, pillow blocks, and hangers.

* * *

Boston Gear Works Inc., North Quincy, Mass., has established a sales office in the Sexton building, Minneapolis, in charge of C. L. Mortenson.

* * *

Allis-Chalmers Mfg. Co., Milwaukee, has removed its Pittsburgh office to 2037 Koppers building. Guy V. Woody is manager of the Pittsburgh district.

* * *

Fostoria Pressed Steel Corp., Fostoria, O., makers of the Sorwal coolant filter, has appointed Fred D. Rankins as sales manager of its newly created industrial division.

* * *

D. L. Orton, formerly sales engineer at the headquarters of Clark Controller Co., Cleveland, has been transferred to the Chicago district office where he will represent the company in a sales and engineering capacity.

* * *

A. W. Lauder has been elected vice president and general manager of Aurora Metal Co., Aurora, Ill. Mr. Lauder was formerly president of Trindl Corp., and prior to that was connected with Lyon Metal Products.

* * *

Meehanite Metal Corp. of America, Pittsburgh, has announced that the following foundries have taken out licenses to manufacture all grades of Meehanite metal: Warren Foundry & Pipe Co., Phillipsburg, N. J.; Wehrle Co., Newark O.; and Florence Pipe Foundry & Machine Co., Philadelphia

* * *

Bunting Brass & Bronze Co., Toledo, O., has established a branch office and warehouse at 3325 Locust street, St. Louis, where it will carry a complete stock of industrial bronze bearings, bronze bars, babbitt, electric motor bearings and similar products.

* * *

E. H. Clark, formerly St. Louis manager for Rockbestos Products Corp., has joined the Harnischfeger Corp. in a sales capacity on the new line of P & H convertible motors. Mr. Clark will represent Harnischfeger in the Middle West and Southwest territory.

* * *

Carl G. de Laval has been appointed sales representative of Electro Metallurgical Sales Corp. in the Pittsburgh district. Since 1925 Mr. de Laval has been connected with the production department of the company at the Niagara Falls plant. His new offices will be in the Oliver building, Pittsburgh.

* * *

Ohio Forge & Machine Co., Cleveland, successor to Gears & Forgings Inc., manufacturer of gears, speed reducers and forgings, has announced the appointment of Denton & Anderson Co., 1225 West Washington boulevard, Chicago, as its representative in the Chicago territory. Associated with George E. King in this office are Clyde G. Bassler, C. A. Gould and John R. Poyser.

—Cross Sections—

ORDERS continue to come in steadily for MACHINE DESIGN'S "Directory of Iron, Steel and Nonferrous Alloys," published as a supplement with the September, 1933, issue. Evidently this compilation of engineering materials, arranged by trade names, is meeting with favor from the men who must make the selection, the designers. Have you a copy? There are still some available at twenty-five cents each.

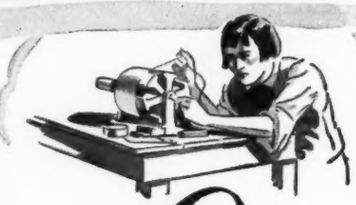
DON'T be surprised to see an announcement within a short time of a vacuum sweeper with a case fabricated from a phenolic resinoid material. Designers of the manufacturer have been studying this change for some time. Another development in the speedily increasing application of this type of material is its consideration for a numbering wheel in a production control unit.

A NEW machine has been developed that will pick up 99 per cent of the walnut crop at harvesting time. If the machine comes into general use throughout the country and is adapted to black walnuts as well as to the English variety, the index of successful application will probably be gaged by the shade of the stain on a small boy's fingers after the first frost.

RELATING to the problem of designing around a patent claim, presented in these columns last month, the method that was upheld by the courts was merely to bore an oversize hole into the earth with an augur and insert a tube without driving or forcing. The claim stated that the instrument is "driven or forced into the earth." A number of our readers solved this one. Are you interested in more of the same, not necessarily limited to the patent field?

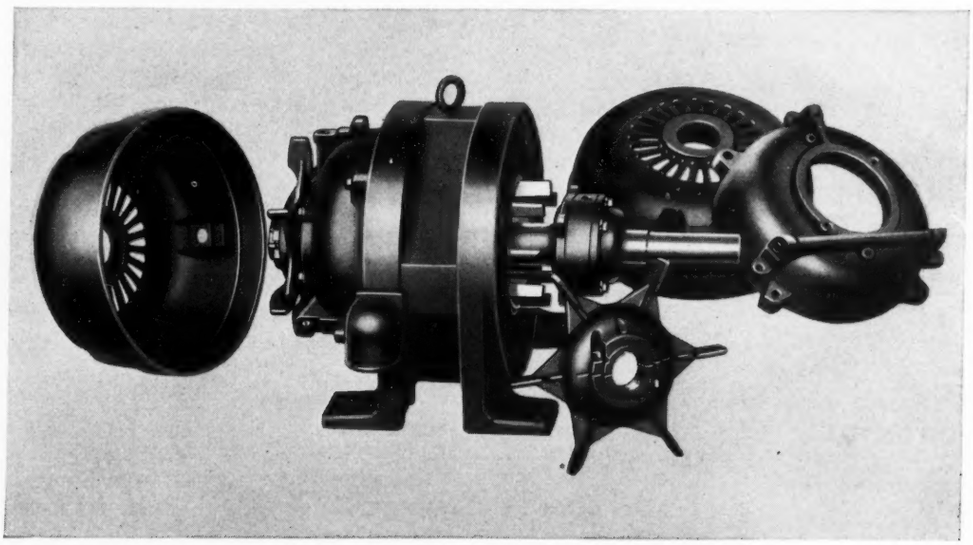
PROVISION for varying speeds has almost become a necessity on most machines, while the vulnerability of change gears, considering their inconvenience and the time required to make the adjustment, has stimulated the search for a better method of securing the change. Three articles on methods of securing variable speed were presented in MACHINE DESIGN in December, 1933, January and February, 1934. A new device gives three forward speeds of 1:1, 1:1¾ and 1:3¼ and a reverse speed of 1:4¼ with the speed change being made almost instantaneously by one hand movement.

THE FRICTION of the air rushing over the surfaces of these new streamlined cars generates considerable static electricity in the body of the car and thus creates another problem that the designer must solve. A chain dangling from a streamlined car would be a little out of place to say the least, so tire builders are attempting to create a ground through the tire. Perhaps some ingenious designer will devise a method for dissipating the charge through a part on the car itself. We don't mind creating a shock for those bridge tenders stepping up to get our dimes and quarters, but a spark jumping from an open gas tank to the nozzle of a gas hose is something else again.



Over a Century of Experience

IN BUILDING PRECISION EQUIPMENT



Over a century of experience.

★ . . . behind these simple words lies a story almost without parallel in service to electricity. This organization saw and *helped* in the first crude developments of the electric motor. And during its development through the years, Fairbanks-Morse has been working with motor users in every branch of industry—working hand in hand to create the finest kind of motors for every conceivable requirement.

Because of this tradition of craftsmanship and of co-operation with users of its motors, Fairbanks-Morse customers have come to look on an F-M Motor as an *investment* in dependability and economy.

Take a particular instance in machine design where motors are required to work in the presence of dust and dirt, metallic particles, steam and moisture—even corrosive gases and fumes. Fairbanks-Morse has developed a totally enclosed, fan-cooled, ball bearing motor with many exclusive features—two non-clogging one-piece fans provide two-direction ventilation—cast-iron enclosing shields—sturdy cast-iron stator heads—semi-annual or annual greasing accomplished without removing any parts. This motor requires no more mounting room than the standard open type motor.

Before you buy or specify a motor for any purpose, it's always the best plan to inspect what Fairbanks-Morse has to offer. For complete information, write Fairbanks, Morse & Co., 900 South Wabash Avenue, Chicago, Ill. 32 branches at your service throughout the United States.

Pioneer Designers and Manufacturers of POWER, PUMPING AND WEIGHING EQUIPMENT 105 Years

FAIRBANKS-MORSE
MOTORS

6304—EA40.71